NATIONAL LUMBER GRADES AUTHORITY

SPS 1

Special Products Standard for Fingerjoined Structural Lumber

Effective March 2017

Approved by the Canadian Lumber Standards Accreditation Board

Supersedes All Previous Editions, Revisions and Supplements

SPS 1

SPECIAL PRODUCTS STANDARD

FOR

FINGERJOINED STRUCTURAL LUMBER

EFFECTIVE: March 1, 2017

Supersedes All Previous Editions, Revisions and

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Approved by the Canadian Lumber Standards Accreditation Board – February 2017

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303 – 409 Granville St
Vancouver, BC, Canada V6C 1T2

Tel: (604) 673-9100

www.nlga.org

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PREFACE

The following is a list of revisions to **SPS 1** since December 2006.

a) Revised Sections Effective December 1, 2006

- Section 9.2.4;
- Section 15.4.2.2.

b) Revised Sections Effective April 4, 2007

- Section 2 – Definitions;
- Section 2.2;
- Section 3.1;
- Section 3.2; and
- Section 3.3
- Section 7.1.1;
- Section 7.1.4; and
- Section 10.2 g).

c) Revised Sections Effective July 14, 2010

- Section 13.8

d) Revised Sections Effective November 1, 2010

- Replace all references "NLGA SPS Annex B – Elevated-Temperature Adhesive Qualification Procedure" in HRA & Non HRA Definitions, Section 3.2.1, Sections 2.2 and 7.1.4 with "ASTM D7374-08 - Practice for Evaluating Elevated Temperature Performance of Adhesives Used in End-Jointed Lumber"
- Section 12.3.2; and
- Section 2.2 – updated Reference Publications.

e) Revised Sections Effective April 2011

- Revised the Flat Bending 5^{th}%ile strength test values in all Test Value Tables; and
- Added "The test values apply only to fingerjoints using a horizontal profile" to the Notes under Test Value Tables

f) Revised Sections Effective February 2013

- Revised Section 9.1.1.2; Added 2 new Tables and revised Table number accordingly;
- Section 13.2 - added (To be performed by the Facility) to the section title; and
- Section 13.3 - added (To be performed by the Agency) to the section.
- Replaced "Calibration" in the Table 9 heading with "Spot-Check" to now read: "Table 8 - Test Equipment Spot-Check Frequency".

g) Revised Sections Effective November 2014

- Updated Section 2.2 – Referenced Publications;
- Revised Section 9.1.1.2 to comply with the ALSC GLP;
- Replaced Tables 3 & 4 with a new Table 3 and renumbered Tables; and
- Revised Section 13.6.1.2 to improve wording of this clause.

h) Revisions Effective March 2017

- Updated Section 2.2 – Referenced Publications;
- Revised Section 7.4.2 to clarify the wording; and
- Updated NLGA Ratified Responses and Attachment 1 at the end of this Standard

1.0 SCOPE

1.1 THIS STANDARD CONSISTS OF TWO PARTS

PART A:

Product Specifications specifies grade characteristics, standard sizes, visual grading and adhesive requirements property requirements, joint evaluation procedures, and grade stamping requirements for Structural Fingerjoined Lumber.

PART B:

Qualification and Quality Control Requirements: specifies minimum qualifications and quality control requirements for a facility producing fingerjoined lumber in accordance with the requirements of PART A of this Standard.

1.2 NLGA STANDARD GRADING RULES

This Standard shall be used in conjunction with and forms part of the NLGA Standard Grading Rules for Canadian Lumber.

1.3 IMPERIAL UNITS

In case of a dispute, the values stated in imperial units shall take precedence.

1.4 DESIGN VALUES

For use in Canada, design values are assigned to fingerjoined lumber by the CSA Technical Committee on Engineering Design in Wood and are published in the current edition of CSA O86. For use in the U.S., design values are published in the NLGA Standard Grading Rules (Para. 900).

1.5 FINGERJOINED STRUCTURAL LUMBER

This Standard applies to visually graded fingerjoined structural lumber. The profile and quality of the fingerjoint shall be established by inspection and test procedures, and the quality of full-length fingerjoined lumber shall be verified by visual grading in accordance with the NLGA Standard Grading Rules.

2.0 DEFINITIONS & REFERENCED PUBLICATIONS

2.1 DEFINITIONS

The following definitions shall apply to this Standard.

AGENCY: an organization accredited by the Canadian Lumber Standards Accreditation Board (CLSAB) and/or the American Lumber Standard Committee (ALSC), Board of Review engaged in the grading, grade stamping and/or certification of lumber or who certifies facilities to grade and place a grade stamp upon lumber.

AGENCY SUPERVISOR: an employee of the Agency who is approved by the Agency to inspect facilities producing fingerjoined lumber.

AGENCY VERIFICATION: a specific set of procedures used by an Agency to verify that an item of post grade stamped fingerjoined lumber conforms to the requirements of this Standard and the NLGA Standard Grading Rules.

BOIL OUT: a characteristic of phenol-resorcinol adhesives cured at high temperatures: the paraformaldehyde hardener decomposes to gaseous formaldehyde more rapidly than the formaldehyde can react with the phenol-resorcinol resin. Unless sufficient pressure is applied to the glueline, the result may be a foamy glueline that is weaker than a normal glueline.

CALIBRATION: a procedure of comparing two instruments, measuring devices or standards, one of which is of known accuracy traceable to a nationally recognised standard.

CONFORMANCE: a state in which the production process meets the requirements of this Standard.

CONTROL CHARTS: are reports or records used to monitor the variation between the process quality level and a predetermined conformance quality level, and to indicate when changes in the process are required to bring the process back into an "**IN-CONTROL**" state as defined by the conformance quality level.

CYCLIC DELAMINATION TEST: a test procedure that simulates environmental conditions to which wood products may be exposed during shipment, storage or use.

DELAMINATION: a separation of the glueline as a result of drying stresses. Reasons for delamination may also include joint mis-manufacture that produces a glueline that is weaker than the wood or delamination may be caused by the glueline being softened by the water. Drying stresses that produce delamination are similar to those that produce checking in wood.

DISPLACEMENT: the amount of clear wood displaced by a characteristic and considered in its relation to the amount it reduces the strength of the cross-section of the piece of lumber under consideration.

EVALUATION: an assessment of the manufacturing process and its quality control programs to determine whether a facility is capable of producing an item that meets the requirements of this Standard.

FACILITY: is a manufacturing plant that produces fingerjoined lumber and conducts visual grading and quality control sampling and testing.

GRADE STAMP (MARK): the grade identification applied on a specimen of fingerjoined lumber shall include the appropriate information under Section 10.0 of this Standard. The grade stamp (mark) indicates that the fingerjoined process meets this Standard and the requirements of the Agency's qualification and quality control procedures.

HEAT RESISTANT ADHESIVE (HRA): an adhesive that meets the elevated temperature performance requirements of ASTM D7374.

HORIZONTAL FINGERJOINT: a profile formed so that an image of the fingers appears on the narrow face of the lumber.

IN-CONTROL: a state in which on-going quality control testing indicates that the production process meets the mechanical property and/or delamination requirements of this Standard.

INSPECTION: the examination, measurement and/or testing of the properties of an item to ensure they meet the quality control requirements of this standard.

INTERCHANGEABLE: capable of being assigned the design values of another product under certain end-use conditions.

Note 1: *The specific end-use conditions are described in this Standard.*

Note 2: *Two products are deemed to be interchangeable only to the extent established by the minimum requirements specified in this Standard. Comparability of properties not explicitly covered by this Standard may require additional assessment.*

ITEM: lumber of a given grade, size (without reference to length), species or species group and moisture content.

NON-CONFORMANCE: a deficiency in a property, documentation or procedure that renders the quality of an item not to be in adherence to specified requirements of this standard and therefore unacceptable. Examples that may cause non-conformance: physical defects, test failures, incorrect or inadequate documentation, or deviations from prescribed processing, inspection or test procedures.

OUT-OF-CONTROL: a state in which on-going quality control testing indicates that the production process does not meet the mechanical property or delamination requirements of this Standard.

QUALITY CONTROL: a set of procedures that provide a means of measuring and regulating the performance of an item to specified requirements.

QUALITY CONTROL MANUAL (PLANT STANDARD): a document which sets forth a specific set of instructions to describe the quality control functions and requirements to be carried out in the production of fingerjoined lumber.

RANDOM SAMPLING: a procedure by which a sample is generated from a population. The sample shall be representative of the population.

RE-QUALIFICATION: analysis of the test results from a random sample drawn from a process that has undergone corrective action in response to an "**OUT-OF-CONTROL**" condition or re-establishing conformance of non-production grades for a period exceeding one year of a particular fingerjoined grade.

SEPARATE-APPLICATION ADHESIVE: a multi-component adhesive that has the following characteristics:

- Each adhesive component is applied separately to one or both sides of the joint.
- All adhesive components are required for the bond strength to be fully developed.
- Some separate-application adhesives require that the components be **blended**[1] in order for the adhesive to develop the required strength and durability. Other systems simply require the components to come into contact with each other.

[1] **Blended** is defined as thoroughly mixing the adhesive components together resulting in a homogeneous mixture.

SHIPMENT: one or more bundles, packages or units of lumber that comprise an order.

SPECIMEN: a piece of fingerjoined lumber randomly selected from production for purposes of quality control, quality verification testing and any subsequent analysis.

SPOT CHECK: the verification that the calibration / device / machine is still within calibration tolerances.

SUBSEQUENT QUALIFICATION: analysis of the test results from a random sample drawn from a process whose production is in-conformance with the requirements of this Standard, but has been modified for reasons other than to respond to a detection of non-conformance. Subsequent qualification procedures apply only to the process changes specified in this Standard. Other process changes shall be evaluated using the Initial Qualification procedures.

TENSION PROOF-LOADING: is a process whereby a piece(s) of fingerjoined lumber is loaded to a pre-determined proof load tensile stress level.

TEST EQUIPMENT: equipment used by the facility to determine the bending strength or resistance to delamination of a finger joint for determining conformance to the specified requirements of this Standard.

TEST LOAD: a load that will induce a stress that corresponds to the property value for the grade under consideration.

VERTICAL FINGERJOINT: a profile formed so that an image of the fingers appears on the wide face of the lumber.

WOOD FAILURE: a type of failure induced on the glue bond in which the fingerjoint is failed by the tearing away of wood fibre from one and/or the other side of the fingerjoint of the two pieces that have been glued.

Note: *If fingers break off at the base or away from the fingerjoint, this is not considered to be wood failure.*

2.2 REFERENCED PUBLICATIONS

ALSC

Glued Lumber Policy (GLP) (Nov 2013)

AWC

NDS® National Design Specification for Wood Construction (2012)

ASTM

D245-06 (2011) Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber

D2915-10 Standard Practice for Evaluating Allowable Properties for Grades of Structural Lumber

D4444-13 Standard Test Methods for Laboratory Standardization and Calibration of Hand-Held Moisture Meters

D7374-08 (2015) Standard Practice for Evaluating Elevated Temperature Performance of Adhesives Used in End-Jointed Lumber

D7438-13 Standard Practice for Field Calibration and Application of Hand-Held Moisture Meters

ASTM

E4-16 Standard Practices for Force Verification of Testing Machines

CLSAB

REGULATIONS (Oct 2016)

CSA

CSA-O86-14
Engineering Design in Wood

CSA-O141-05 (R2014)
Softwood Lumber

CSA-O112.7-M1977 (R2001)
Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood

CSA-0112.9-10 (R2014)
Evaluation of Adhesives for Structural Wood Products (Exterior Exposure)

NLGA

Standard Grading Rules for Canadian Lumber (Jan 2014)

PART A - PRODUCT SPECIFICATIONS FOR FINGERJOINED STRUCTURAL LUMBER

3.0 PRODUCT DESCRIPTION

3.1 APPLICATIONS

Fingerjoined lumber produced to the requirements of SPS 1 is interchangeable with non-fingerjoined lumber of the same grade and length pursuant to the following restrictions:

a) Fingerjoined lumber cannot be visually re-graded or re-manufactured into a higher stress grade even if the quality of the lumber containing fingerjoints would otherwise warrant such re-grading;

b) Fingerjoining of lumber for the manufacture of horizontally laminated timbers is not within the scope of this Standard.

Note: *Fingerjoined lumber for laminated timber is covered by laminated timber standards.*

3.2 SPECIAL APPLICATIONS

3.2.1 HEAT RESISTANT ADHESIVES

Fingerjoined lumber marked "**HRA**" is manufactured with a heat resistant adhesive that meets the requirements of ASTM D7374. Fingerjoined lumber marked as "**HRA**" and used in non-standard fire rated assemblies may require additional fire protection.

Note: *See ASTM D7374 for background on standard fire-rated assembly.*

3.2.2 CHEMICALLY TREATED WOOD

Fingerjoining chemically treated lumber or chemical treatment of fingerjoined lumber are not within the scope of this Standard.

3.3 DEMONSTRATION OF CONFORMANCE

Lumber represented as conforming to the requirements of this Standard shall be manufactured using a process in which the quality of the fingerjoints produced is continuously in accordance with all the requirements specified herein. Product conformance shall be recorded by maintaining records and charts on the results of the inspection and test procedures.

4.0 GRADE DESCRIPTION

This Standard applies to visually graded fingerjoined lumber in all the species groups as defined in Section 6.0 and to the grade classifications of Light Framing, Structural Light Framing, Joists and Planks, Studs and Decking, as specified in the NLGA Standard Grading Rules.

5.0 STANDARD SIZES

Standard thickness and widths for fingerjoined lumber produced in accordance with this Standard are shown in Table 1. Other thickness and widths can be used on qualification.

TABLE 1 - STANDARD THICKNESS AND WIDTHS (FROM CSA O141)

Nominal Dimension	Specified Dimension			
	Imperial (inches)		Metric (mm)	
Thickness	**Dry**	**Green**	**Dry**	**Green**
1	¾	25/32	19	20
1-1/4	1	1-1/32	25	26
1-1/2	1-1/4	1-9/32	32	33
2	1-1/2	1-9/16	38	40
Width	**Dry**	**Green**	**Dry**	**Green**
2	1-1/2	1-9/16	38	40
3	2-1/2	2-9/16	64	65
4	3-1/2	3-9/16	89	90
5	4-1/2	4-5/8	114	117
6	5-1/2	5-5/8	140	143
8	7-1/4	7-1/2	184	191
10	9-1/4	9-1/2	235	241
12	11-1/4	11-1/2	286	292

6.0 LUMBER REQUIREMENTS

6.1 SPECIES

The lumber used in the manufacture of fingerjoined structural lumber may be of any species in the species combinations specified in the NLGA Standard Grading Rules.

These species may be combined in any combination that preserves the species combination. Species from different species combinations shall not be mixed within the same piece.

6.2 WOOD QUALITY IN THE JOINT

6.2.1 For the grades of Select Structural, No. 1 and No. 2, the fingerjoints shall be formed in sound wood that otherwise meets the slope of grain and other visual requirements of the grade, except as provided for in Sections 6.2.3 and 6.2.4.

6.2.2 In all other grades, the fingerjoints shall be formed in wood that meets the requirements of No. 2 or Standard grades, except as provided in Sections 6.2.3, 6.2.4 and 6.2.5.

6.2.2.1 The joint may contain pitch and/or firm honeycomb not exceeding 10% displacement.

Note: *10% displacement refers to: only one piece of the joint; or the combination of both pieces of the joint.*

6.2.3 **Knots**: In all grades, the fingers shall not contain knots that exceed the size of knots listed in Table 2.

Knots appearing on the narrow faces are permitted the same cross-sectional area displacement as knots specified on wide faces. All knots exceeding the displacement shall be set back from the base of the fingers so that neither the knot(s), nor the grain distortion associated with the knot(s), extend into the fingers.

6.2.4 **Wane:** shall not exceed half the thickness in any grade. Wherever possible, the wane on the two pieces forming the joint shall be placed at the same corner of the joint.

6.2.5 **Slope of grain:** 1 in 4 for Standard and 1 in 8 for Const., No. 3 and Stud grades.

6.3 LUMBER QUALITY

The finished product shall be visually graded in accordance with the provisions of the NLGA Standard Grading Rules for Canadian Lumber.

6.4 FINGER PROFILE

The orientation of the finger profile may be manufactured into the lumber at any angle; however, the finger profile shall be formed in a plane at right angles to the longitudinal axis of the lumber being joined.

TABLE 2 - KNOT SIZES IN JOINT AREA

Nominal Width	Select Str.		No. 1		No. 2		Construction, Standard, Utility, Stud & No. 3	
(inches)	**(Inches)**	**(mm)**	**(Inches)**	**(mm)**	**(Inches)**	**(mm)**	**(Inches)**	**(mm)**
2”	3/16”	5	¼”	6	¼”	6	⅜”	9.5
3”	¼”	6	⅜”	9.5	½”	13	⅝”	16
4”	⅜”	9.5	½”	13	¾”	19	⅞”	22
5”	½”	13	⅝”	16	⅞’	22	1⅛”	29
6”	⅝”	16	¾”	19	1”	25	1⅜”	35
8”	¾”	19	1”	25	1⅛”	29	1⅝”	41
10”	1”	25	1⅛”	29	1⅜”	35	1⅞”	48
12”	1¼”	32	1¼”	32	1½”	38	2”	51

6.5 FINGERJOINT TOLERANCES

The tolerances on machining and assembly of the finger profile shall be such that when the end pressure and the face pressure are applied in the gluing process (make-up), the following conditions are met:

6.5.1 **"Tip gap":** which is the distance from the tip of any finger in the joint area to the base of the matching profile for that finger, must not exceed $^{1}/_{16}$" (1.6 mm).

6.5.2 **"Fingerjoint offset":** between the surfaces of the lumber, in either lateral or vertical directions, must not exceed $^{1}/_{16}$" (1.6 mm).

6.6 MOISTURE CONTENT

Green and dry lumber shall not be mixed within the same specimen.

7.0 ADHESIVE REQUIREMENTS

7.1 ADHESIVE SPECIFICATION

7.1.1 GENERAL

The adhesive used for joining of the fingerjoints shall meet Section 7.1.4 and either Section 7.1.2 or Section 7.1.3 of this Standard.

7.1.2 RESORCINOL & PHENOL RESORCINOL ADHESIVES

The adhesive used for joining the fingerjoints shall meet the requirements of *CSA O112.7-M1977, Resorcinol and Phenol-Resorcinol Adhesives for Wood*. The adhesive may be mixed with the minimum amount of inert fillers required for its performance in the particular process being used.

7.1.3 ALTERNATE ADHESIVES

The adhesive used for joining the fingerjoints shall meet the requirements of CSA O112.9-10 (R2014) when evaluated for one of the softwood species specified in the Standard.

7.1.4 ELEVATED TEMPERATURE

The adhesive shall meet the requirements of ASTM D7374.

7.2 "SEPARATE APPLICATION" ADHESIVES

7.2.1 GENERAL

7.2.1.1 NON-PERMISSIBLE "SEPARATE-APPLICATION" ADHESIVES

"Separate application" adhesives are **not permitted** when components, which are applied separately, need to be blended in order that the joint achieves the required bond strength and durability.

7.2.1.2 PERMISSIBLE "SEPARATE APPLICATION" ADHESIVES

"Separate application" adhesives utilising additional components that only require contact between the components in order to develop the required bond strength and durability are **permitted** provided the requirements of Sections 7.2.2 and 7.2.3 are met.

7.2.2 MONITORING REQUIREMENTS

In addition to meeting the requirements of Section 7.2.1.2, the following information shall be provided and documented in the Plant Standard:

a) Procedures for continuous monitoring of the proportions of the components applied to joint, and the coverage required for each component;

b) Systems for notifying the operator when the component proportions or coverage are beyond the acceptable limits as defined in the adhesive specification. Acceptable operating limits shall be qualified under Section 7.2.3;

c) Procedures for identifying the production that was produced while the adhesive application system was operating outside of the acceptable limits. Such production shall be evaluated in accordance with Section 15.4.2.

7.2.3 QUALIFICATION

Prior to performing the qualification requirements outlined in Section 13.7.2, the procedures outlined in Section 13.3 shall be used to qualify both the upper and lower limits of that provided in the adhesive specification. Joints shall be sampled as specified in Section 13.3 from production set to operating conditions corresponding to the upper component proportions or coverage and tested in accordance with Section 13.3. This sampling and testing shall be repeated for production set to operating conditions corresponding to the lower component proportions or coverage.

7.3 ADHESIVE MIXING

Mixing of the adhesive shall be performed in accordance with the instructions of the adhesive supplier.

7.4 JOINT FABRICATION

7.4.1 ADHESIVE APPLICATION

The adhesive shall be applied to the finger profiles in a manner that will ensure that all the gluing surfaces between the fingers receive a sufficient amount of adhesive that result in squeeze out of excess glue when the end pressure is applied. The adhesive may be applied to one or both sections forming the joint.

7.4.2 HEAT DAMAGE

Where a procedure is used to apply heat to the finger profile, it shall be such as to ensure that neither the wood surfaces in the profile nor the wood itself are damaged by excess heat.

Note: *In Radio Frequency (RF) curing, wood damage may result from excessively long exposure of the finger profile to the RF field.*

In either situation both the strength and the long-term durability of the joint may be impaired.

7.4.3 END PRESSURE

The end pressure applied during the joint assembly process and while the glueline is being cured, shall be that required for the specific lumber size, species, finger profile and process used. Pressure shall not be such as to produce splitting in the wood at the base of the fingers.

8.0 PROPERTY REQUIREMENTS

The following requirements shall apply to the test values as provided in Tables 4 to 7.

8.1 MODULUS OF RUPTURE (MOR)

The minimum requirements for both flat and edge bending strengths are determined in accordance with the test procedures set forth in Section 9.1, which are:

8.1.1 MINIMUM MODULUS OF RUPTURE

"**All**" of the test results shall meet or exceed the minimum bending strength as provided in Tables 4 to 7.

8.1.2 FIFTH PERCENTILE (5^{th} %ile) MODULUS OF RUPTURE (MOR_{5th})

The process lower fifth percentile for modulus of rupture (MOR_{5th}) shall equal or exceed the fifth percentile (5^{th} %ile) test value for the grade as provided in Tables 4 to 7 when subjected to a short-term test load and tested in accordance with Section 9.1.

8.2 DELAMINATION

The average delamination of the joint, measured in accordance to the test procedures in Section 9.2, shall not exceed 10% at the completion of the three cycles. Joints in which the delamination at the end of 1 cycle does not exceed 5% shall be considered to meet this requirement.

In addition, the delamination on a single specimen shall not exceed 15%. Average delamination of the joint is the average of the delamination found in the two test specimens, except that if only one test specimen is obtained from a short-fingered joint, the average delamination of the joint is that obtained from that single test specimen.

8.3 TENSION PROOF LOADING

For No. 2 and higher grades, all production shall meet the proof load tension stress levels for the species, sizes and grades as provided in Tables 4 to 7.

8.4 FINAL GRADE

The final grade of the fingerjoined lumber shall be determined by the lower of the visual grade of the lumber or the stress grade determined by strength tests on the fingerjoints.

9.0 JOINT EVALUATION PROCEDURES

9.1 MODULUS OF RUPTURE (MOR)

9.1.1 MOR SPECIMEN SIZE

9.1.1.1 A specimen for determination of bending strength shall consist of a full-size piece of fingerjoined lumber containing at least one fingerjoint positioned in such a way that when the specimen is tested in bending, the fingerjoint is located at mid-span. The length of the specimen shall be such that the overhang is not less than 4" (100mm), and not more than 10" (250mm), unless appropriate corrections are made to the load values to compensate for longer overhangs.

The specimen shall not be surfaced or machined in any way prior to test, except as provided for in Section 9.1.1.2, unless such surfacing or machining is an integral part of the manufacturing process.

9.1.1.2 REDUCED WIDTH MOR SPECIMEN

9.1.1.2.1 In the event that the test equipment will not permit full-width edgewise MOR testing, a nominal 2x4 (3.50 in) test piece is permitted to be ripped lengthwise from the full-width test piece provided it includes an as-manufactured original narrow face**.**

9.1.1.2.2 The reduced-width (ripped) 2x4 test pieces shall be used for the reduced-width MOR testing with an as-manufactured narrow face being randomly selected for testing (random relative to the transverse feed direction).

9.1.1.2.3 The reduced-width (ripped) 2x4 test pieces shall be prepared and tested with the as-manufactured narrow face in tension**.**

9.1.1.2.4 The bending strength result of the test piece shall be divided by the appropriate reduced-width factor given in Table 3.

TABLE 3 – REDUCED-WIDTH FACTORS

Reduced-Width Bending Strength Factors					
Actual Ripped Reduced-Width	**Original (Un-ripped) Lumber Nominal Width**				
3.5"	**5" (2x5)**	**6" (2x6)**	**8" (2X8)**	**10" (2x10)**	**12" (2x12)**
	1.03	1.06	1.11	1.18	1.26

Note: *The reduced width factor (RWF) is based on the formula used in Table 2 of the ALSC Glued Lumber Policy and noted below:*

$$RWF = (7270 - (177 \times h_1)) / (7270 - (177 \times h_2))$$

Where: h_1 *= the reduced specimen dimension in the direction of the applied load; &*

h_2 *= the full board width specimen dimension.*

9.1.1.2.5 The reduced-width test results shall meet the appropriate bending-strength values (for the original size) found in Tables 4 to 7 of this Standard.

Example (for 2x10, S-P-F, No. 2):

1) *From the full-width 2x10 test piece, rip a nominal 2x4 (3.50") test piece such that it includes one randomly selected as-manufactured narrow face;*

2) *Test the ripped 2x4 test piece for MOR with the as-manufactured narrow face in tension to failure and record the bending-strength result;*

3) *Determine the size-adjusted test result by dividing the bending-strength test result by **1.18** (the reduced-width bending-strength factor for 2x10); and*

4) *As per PART B of the Standard, compare the size-adjusted test result to the required Min & 5th %ile test value for 2x10, S-P-F, NO. 2 in Table 4, which is 2020 and 2320 respectively.*

9.1.2 MOR TEST PROCEDURE

Four-point loading shall be used, with the two loading points symmetrically placed on either side of the fingerjoint. The loading points shall be placed adjacent to and spanning the fingerjoint, approximately 2" (50 mm) from the joint area (see APPENDIX I, Figure 1). The load shall be applied at a uniform rate of movement of the loading head so that the time to maximum load is approximately one minute and in no case less than 35 seconds in any one test.

The test-loading rate must not exceed the ability of the load-measuring device on the testing machine to respond accurately.

The specimen shall be tested with a shear span to depth ratio between 15 and 20, where depth is the dimension of the specimen under test in the direction in which the loading force is applied.

9.1.3 MOR CALCULATION & REPORT

Using the specified dimensions of the test specimen, calculate the MOR from the breaking loads as shown in the example in APPENDIX I, Figure 1, and record the MOR for each test specimen.

The specified dimensions are the dimensions as provided in Table 1. These specified dimensions are also used to calculate MOR when joints are tested in green lumber.

If a failure occurs outside of the fingerjoint, it shall be recorded in the quality control records including the cause for the failure.

Note: *A failure that occurs outside of the fingerjoint is not recorded as a joint failure. However, if the failure occurring outside of the fingerjoint is below the minimum edge or flat bending strength as provided in Tables 4 to 7 then it shall be replaced with another joint sample.*

9.2 DELAMINATION RESISTANCE EVALUATION

9.2.1 DELAMINATION TEST SPECIMEN

Green lumber shall be dried to 19% or less moisture content prior to performing the delamination test.

9.2.1.1 FINGER PROFILES GREATER THAN $^{5}/_{8}$ INCH (16 mm) IN LENGTH – LONG-FINGERED (LF) JOINTS

The LF test specimen shall consist of a section of the fingerjoined lumber approximately 7 inches (180 mm) long with the fingerjoint in the centre of the length. The specimen shall be cross-cut through the centre of the joint to yield two test specimens.

9.2.1.2 FINGER PROFILES $^{5}/_{8}$ INCH (16 mm) & LESS IN LENGTH – SHORT-FINGERED (SF) JOINTS

The fingers of the SF test specimen shall be cross cut at the tips of the fingers to yield one test specimen approximately 3½" (89 mm) in length with the glueline visible in the end grain.

9.2.2 DELAMINATION TEST PROCEDURE

Place the test specimens in the pressure vessel and weight them down. Admit sufficient water at a temperature of 65˚ to 85˚F (18.3˚ to 29.4˚C), so that the test specimens are completely submerged.

Separate the test specimens by stickering, wire screens or other means so that all end grain surfaces are freely exposed to water.

Draw a vacuum of 20 to 25 inches (508 to 635 mm) of mercury and hold it for 30 minutes, then release the vacuum and apply a pressure of 75±5 psi (0.520 ± 0.034 MPa) for a period of two hours.

Dry the test specimens using air at a temperature of 160˚±5˚F (71˚±3˚C). The air circulation and number of specimens in the oven at any one time shall be selected such that the specimens are dried to moisture content of 19% or less.

During drying, place the specimens at least 2 inches (50 mm) apart, with the end grain surfaces and finger orientation parallel to the direction of the airflow (refer to Figure 2 in APPENDIX V).

Dry the specimens until the moisture content (MC) of each specimen has reached 19% or less. Measure and record the delamination immediately, following the procedures set forth in Section 9.2.3.

Note: *In ordinary circumstances drying the specimens overnight (up to 18 hours) should achieve the desired drying, provided the drying chamber is functioning as specified.*

9.2.3 MEASUREMENT OF DELAMINATION

At the end of the drying period, immediately examine the crosscut surface of the specimens for separations of the bondlines), and probe any indeterminate areas with a 0.004 inch (0.102 mm) feeler gauge.

All bondline separation shall be considered as delamination except for the following:

a) Ignore any separation in the bondlines adjacent to the outer fingers, any separation less than 0.10 inch (2.5 mm) long, and any separation within the knot boundaries visible in the crosscut surface.

b) Where glueskip is present, it is permitted to ignore to a maximum of 10% of the total bondline that is shown to be due to glueskip. Such samples shall be marked to indicate the glueskip and the records shall show the amounts deducted from the delamination calculations.

Note: *Action should be taken to identify the causes of and prevent glueskip in the joint. If glueskip is suspected, the joint should be opened and the bondlines examined. The use of aids such as indicator dyes and appropriate lighting should be used to identify areas where adhesive is not present.*

Measure the length of the delaminated portions to the nearest 1/16 inch (1.6 mm). Add the various lengths together.

Note: *Testing should be done immediately because if the delamination specimens are removed from the oven and allowed to pick up moisture from the atmosphere, the bondline separation will tend to close.*

9.2.3.1 INITIAL QUALIFICATION, RE-QUALIFICATION & RE-INSPECTION TESTING

If the delamination of the specimen (Section 9.2.1.2) or, if applicable, the average delamination of a specimen and its matching specimen (Section 9.2.1.1) after one vacuum, pressure and drying cycle exceeds 5% but is less than 10%, repeat the above vacuum, pressure, drying cycle twice on that specimen and its matching specimen (if any), and record the delamination at the end of the third cycle.

9.2.3.2 QUALITY CONTROL, VERIFICATION & RE-INSPECTION TESTING

Results from daily quality control, verification, and re-inspection test specimens shall be reported after one cycle of vacuum, pressure and drying.

9.2.4 DELAMINATION CALCULATION & REPORT

The percentage delamination of a specimen is the sum of all the delamination found (excluding the outermost gluelines), divided by the total length of all the gluelines in which the delamination was measured, times 100. Report the percentage delamination of each specimen, the average percentage delamination for the joint.

9.2.4.1 When delamination in a fingerjoint exceeds 10%, the fingerjoint shall be sawn from the wood and the gluelines cleaved open, so that the cause of delamination may be determined. Causes of delamination shall be included in the quality control report.

Note: *In facilities that use RF heating of the glueline, the exposed cross-section of the test specimens may show any overheating of the joint area as a discoloration of the wood. Most commonly, the delamination is caused by glue skip, but may also result from heat damage to the gluing surfaces. Heat damage may result in delamination to an area that shows shallow wood failure. A poorly manufactured finger profile may also contribute to delamination.*

9.2.4.2 The Agency as part of its "Policies and Procedures" may request a facility to hold the delamination test samples intact for examination.

9.3 TENSION PROOF-LOADING

When required, all fingerjoints shall be proof loaded by applying a tensile stress for the species, size and grade as provided in Tables 4 to 7.

Note: *Occasional fingerjoints that appear near the ends and fall within the grips may be excluded from this requirement. However, production processes where the fingerjoints are consistently located within the grips shall not be permitted.*

The load shall not induce a rate of stress increase that will exceed 130,000 psi/min (14.9 MPa/sec).

9.4 ENVIRONMENTAL CONDITIONS

9.4.1 MEASUREMENT OF MOISTURE CONTENT AT TIME OF TEST

For each bending test specimen, a moisture content measurement using a resistance type moisture meter shall be made each side of the joint. Each of the readings shall be recorded as the moisture content of the specimen(s) segment at the time of test.

In the case of specimens that require ripping, measurements shall be taken and recorded for each rip and on each side of the ripped sample and the average moisture content (one MC value) reported as the moisture content for each side of the joint at the time of test.

9.4.2 TEMPERATURE

9.4.2.1 EQUIPMENT

The temperature of the test equipment shall, at the time of the test, be in the range of 50° to 90° F (10° to 30° C) inclusive. If the proof loading equipment is operated at temperatures below 50°F (10°C), the equipment shall be calibrated at a temperature within ±10°F (5°C) of the temperature at which the equipment will be operated.

9.4.2.2 FINGERJOINT TEST SPECIMENS

Test specimens shall be stored under the same environmental conditions (within ±10°F or ±5°C) as the production until the start of the bending strength and/or delamination test.

10.0 GRADE STAMPING REQUIREMENTS

10.1 GENERAL

All previous grade stamps shall be removed or obliterated.

10.2 REQUIREMENTS

For all fingerjoined lumber produced in conformance with the requirements of this Standard, the grade stamp on each piece shall contain:

a) the registered symbol of the Agency;
b) the facility identification;
c) the species or species combination identification;
d) the seasoning designation;
e) the grade;
f) the expressions "**SPS 1"** & "**CERT FGR JNT";**
g) the expression "**HRA**"

TABLE 4 – FINGERJOINT TEST VALUES [1] [2] FOR BENDING STRENGTH & TENSION STRESS PROOF-LOAD LEVELS FOR S-P-F

Size	Grade	Edge Bending Strength (psi)		Flat Bending Strength (psi)		Tension Stress Proof-load Level [3] (psi)
		Min	5th %ile	Min	5th %ile	All
2x2 & 2x3	Select Str	3940	4330	3940	4480	1400
	No. 1 / No. 2	2790	3070	2790	3210	900
	No. 3 / Stud	1650	1820	1650	1900	
	Const	2130	2340	2130	2450	
	Stand	1200	1310	1200	1370	
2x4	Select Str	3940	4530	4330	4980	1400
	No. 1 / No. 2	2790	3210	3030	3490	900
	No. 3 / Stud	1650	1900	1730	1990	
	Const	2130	2450	2310	2660	
	Stand	1200	1370	1270	1460	
2x6	Select Str	3410	3920	3920	4510	1210
	No. 1 / No. 2	2390	2750	2750	3160	780
	NO. 3 / Stud	1370	1570	1570	1810	
2x8	Select Str	3150	3620	3620	4170	1120
	No. 1 / No. 2	2210	2540	2540	2920	720
	No. 3	1260	1450	1450	1670	
2x10	Select Str	2890	3320	3470	3980	1020
	No. 1 / No. 2	2020	2320	2430	2790	660
	No. 3	1160	1330	1390	1590	
2x12	Select Str	2630	3020	3150	3620	930
	No. 1 / No. 2	1840	2110	2210	2540	600
	No. 3	1050	1210	1260	1450	

[1] The bending strengths and proof tensile stress levels are derived from the CSA O86 - Engineering Design in Wood, or the Supplement to the U.S. National Design Specification for Wood Construction®, whichever is a higher test value for a given species, size and grade.

[2] The test values apply only to fingerjoints using a horizontal profile.

[3] The Proof-load Tension Stress Level is set at 1.33 / 2.1 times the Tensile Strength.

TABLE 5 – FINGERJOINT TEST VALUES [1] [2] FOR BENDING STRENGTH & TENSION STRESS PROOF-LOAD LEVELS FOR HEM-FIR (N)

Size	Grade	Edge Bending Strength (psi)		Flat Bending Strength (psi)		Tension Stress Proof-load Level [3] (psi)
		Min	5th %ile	Min	5th %ile	All
2x2 & 2x3	Select Str	4100	4500	4100	4500	1550
	No. 1 / No. 2	3150	3470	3150	3470	1150
	No. 3 / Stud	1810	1990	1810	1990	
	Const	2420	2660	2420	2660	
	Stand	1370	1500	1370	1500	
2x4	Select Str	4100	4710	4500	5180	1550
	No. 1 / No. 2	3150	3620	3470	3980	1150
	No. 3 / Stud	1810	2080	1990	2290	
	Const	2420	2780	2660	3050	
	Stand	1370	1570	1500	1830	
2x6	Select Str	3550	4080	4080	4690	1340
	No. 1 / No. 2	2730	3140	3140	3610	990
	No. 3 / Stud	1570	1810	1810	2080	
2x8	Select Str	3280	3770	3770	4330	1240
	No. 1 / No. 2	2520	2900	2900	3330	920
	No. 3	1450	1670	1670	1920	
2x10	Select Str	3000	3450	3600	4140	1130
	No. 1 / No. 2	2310	2660	2770	3190	840
	No. 3	1330	1530	1590	1830	
2x12	Select Str	2730	3140	3280	3770	1030
	No. 1 / No. 2	2100	2420	2520	2900	760
	No. 3	1210	1390	1450	1670	

(1) The bending strengths and proof tensile stress levels are derived from the CSA O86 - Engineering Design in Wood, or the Supplement to the U.S. National Design Specification for Wood Construction®, whichever is a higher test value for a given species, size and grade.

[2] The test values apply only to fingerjoints using a horizontal profile.

[3] The Proof-load Tension Stress Level is set at 1.33 / 2.1 times the Tensile Strength.

TABLE 6 – FINGERJOINT TEST VALUES [1] [2] FOR BENDING STRENGTH & TENSION STRESS PROOF-LOAD LEVELS FOR D FIR-L (N)

Size	Grade	Edge Bending Strength (psi)		Flat Bending Strength (psi)		Tension Stress Proof-load Level [3] (psi)
		Min	5th %ile	Min	5th %ile	All
2x2 & 2x3	Select Str	4160	4570	4250	4680	1660
	No. 1 / No. 2	2680	2950	2680	2950	1000
	No. 3 / Stud	1510	1660	1500	1650	
	Const	1930	2130	2000	2190	
	Stand	1090	1200	1100	1210	
2x4	Select Str	4160	4780	4680	5380	1660
	No. 1 / No. 2	2680	3080	2950	3390	1000
	No. 3 / Stud	1510	1740	1650	1890	
	Const	1930	2220	2190	2520	
	Stand	1090	1260	1210	1390	
2x6	Select Str	3600	4140	4240	4870	1440
	No. 1 / No. 2	2320	2670	2670	3070	860
	No. 3 / Stud	1310	1510	1490	1710	
2x8	Select Str	3330	3830	3910	4500	1330
	No. 1 / No. 2	2140	2460	2460	2830	800
	No. 3	1210	1390	1380	1580	
2x10	Select Str	3050	3510	3740	4300	1220
	No. 1 / No. 2	1960	2260	2360	2710	730
	No. 3	1110	1280	1320	1510	
2x12	Select Str	2770	3190	3400	3910	1110
	No. 1 / No. 2	1790	2050	2140	2460	670
	No. 3	1010	1160	1200	1380	

[1] The bending strengths and proof tensile stress levels are derived from the CSA O86 Engineering Design in Wood, or the Supplement to the U.S. National Design Specification for Wood Construction®, whichever is a higher test value for a given species, size and grade.

[2] The test values apply only to fingerjoints using a horizontal profile.

[3] The Proof-load Tension Stress Level is set at 1.33 / 2.1 times the Tensile Strength.

TABLE 7 - FINGERJOINT TEST VALUES [1] [2] FOR BENDING STRENGTH & TENSION STRESS PROOF-LOAD LEVELS FOR NORTH SPECIES

Size	Grade	Edge Bending Strength (psi)		Flat Bending Strength (psi)		Tension Stress Proof-load Level [3] (psi)
		Min	5th %ile	Min	5th %ile	All
2x2 & 2x3	Select Str	3150	3470	3150	3470	970
	No. 1 / No. 2	1890	2080	1890	2080	630
	No. 3 / Stud	1100	1210	1100	1220	
	Const	1470	1620	1470	1620	
	Stand	840	920	840	920	
2x4	Select Str	3150	3620	3470	3980	970
	No. 1 / No. 2	1890	2170	2080	2390	630
	No. 3 / Stud	1100	1270	1210	1390	
	Const	1470	1690	1620	1860	
	Stand	840	970	920	1060	
2x6	Select Str	2730	3140	3140	3610	840
	No. 1 / No. 2	1640	1880	1880	2170	540
	No. 3 / Stud	960	1100	1100	1260	
2x8	Select Str	2520	2900	2900	3330	780
	No. 1 / No. 2	1510	1740	1740	2000	500
	No. 3	880	1010	1010	1170	
2x10	Select Str	2310	2660	2770	3190	710
	No. 1 / No. 2	1390	1590	1660	1910	460
	No. 3	810	930	970	1120	
2x12	Select Str	2100	2420	2520	2900	650
	No. 1 / No. 2	1260	1450	1510	1740	420
	No. 3	740	850	880	1010	

[1] *The bending strengths and proof tensile stress levels are derived from the CSA O86 Engineering Design in Wood, or the Supplement to the U.S. National Design Specification for Wood Construction®, whichever is a higher test value for a given species, size and grade.*

[2] *The test values apply only to fingerjoints using a horizontal profile.*

[3] *The Proof-load Tension Stress Level is set at 1.33 / 2.1 times the Tensile Strength.*

PART B - QUALIFICATION AND QUALITY CONTROL REQUIREMENTS

11.0 EQUIPMENT

The facility's fingerjoining test and delamination equipment shall meet the following requirements:

11.1 MOR TEST EQUIPMENT ACCURACY

The bending test equipment shall provide the functions illustrated in APPENDIX I (Figure 1), with a roller action on the reaction supports and sufficient radius on the loading points to avoid significant crushing of the wood. Side supports to prevent buckling of lumber tested on edge shall also be provided.

The load measuring equipment shall be accurate to within ± 2% of the actual load. The load shall be applied through a cross-head.

11.2 DELAMINATION EQUIPMENT

11.2.1 PRESSURE VESSEL

An autoclave or similar pressure vessel designed to safely withstand a pressure of at least 100 psi (0.7 MPa) is required for impregnating the specimens with water. The pressure vessel shall be equipped with a means of obtaining a vacuum of at least 25 inches (635 mm) of mercury (at sea level), and a means of obtaining a pressure of at least 75 psi (0.52 MPa) (gauge pressure). The vessel shall be equipped with a gauge(s) to register vacuum and pressure.

Note: *A suitable vacuum may be obtained from an aspirator attached to the water supply, and 75 psi (0.52 MPa) can usually be obtained from a municipal water supply or a compressed air supply.*

11.2.2 DRYING OVEN

The drying oven shall be capable of maintaining the conditions necessary to dry specimens to moisture content of 19% or less.

Note: *These drying conditions are those obtainable in cross-flow, laboratory type ovens of the circulating type. They can also be obtained by using a non-circulating configuration in which air heated by a space heater is passed over the specimens and vented.*

Conditions that affect the drying rate include cross-flow air velocity, humidity, air temperature and the arrangement, size and number of specimens in the oven.

Circulating type ovens that provide a cross-flow air velocity of 250 ±50 fpm (75 ±15 m/min) in the centre of the drying chamber and maintain an air temperature of 160˚ ±5˚F (71˚ ±3˚C) should be capable of achieving the specified drying rate.

11.3 TENSION TESTING EQUIPMENT ACCURACY

The load measuring device shall be accurate to within ± 2% of the actual load.

12.0 QUALITY CONTROL MANUAL (PLANT STANDARD) AND RESPONSIBILITIES

12.1 GENERAL

The Quality Control Manual (Plant Standard) is a written description of the manufacturing operation, broken down by station (See APPENDIX II).

12.2 QUALITY CONTROL PERSONNEL

The quality control personnel shall be directly responsible to the facility management and not subordinated to production or sales.

Persons responsible for quality control shall possess and demonstrate to the satisfaction of the Agency that they have adequate knowledge of the manufacturing process, which shall include:

a) Inspection and test procedures used to control the process;
b) Operation and calibration of the recording and test equipment used;
c) Maintenance and interpretation of quality control records;

In addition, the quality control personnel shall be responsible for carrying out and maintaining records of various inspections, and test procedures detailed in the Quality Control Manual.

The quality control personnel shall formally advise the facility management of circumstances resulting from the inspections and test procedures that indicate corrective action may be necessary in the production process.

12.3 PREPARATION, REVISION & APPROVAL

Each facility shall:

a) Prepare and maintain a Quality Control Manual in compliance with the latest edition of this Standard and shall submit the manual to the Agency for approval;
b) Regularly review and update its Quality Control Manual to reflect current production practices and procedures, quality control policies and quality control program procedures and resubmit to the Agency; and
c) Upon approval, implement the updated program in accordance with the Quality Control Manual.

The Agency must approve the Quality Control Manual at the time of qualification. Qualification shall apply only to the manufacturing, quality control procedures and limits set forth in the Quality Control Manual.

The Agency shall be notified in advance of any changes in the Quality Control Manual that may affect product quality. Failure to have such changes approved prior to implementation, or failure to maintain the process in compliance to the requirements of this Standard and the Quality Control Manual, shall be grounds for disciplinary action.

12.3.1.1 QUALITY CONTROL PROCEDURES

The Quality Control Manual shall include detailed procedures specifying how each of the following is to be performed and controlled:

a) FJ equipment, test equipment operation and all calibration;
b) Quality control sampling, testing and analysis;
c) Documentation and record keeping;
d) Identification and trace-ability;
e) Non-conformance, and
f) Corrective action.

12.3.2 AGENCY

The Quality Control Manual shall identify the Agency.

CLSAB and ALSC accredited agencies shall include an explanation of the following in their certification and quality control procedures:

a) That their glued lumber certification and quality control procedures comply with the ALSC Glued Lumber Policy and the CLSAB Regulations;
b) That the responsibility for the certification and quality control procedures is that of the Agency; and
c) That the CLSAB and the ALSC shall monitor that certification and quality control procedures are being carried out by the Agency.

13.0 QUALIFICATION REQUIREMENTS

13.1 INITIAL QUALIFICATION

13.1.1 GENERAL

A facility requesting qualification shall provide the Agency with evidence that all the requirements of PART A of this Standard have been met. Upon receipt of the request, the agency supervisor shall visit the facility to determine that:

a) The facility is capable of operating within the requirements of this Standard and its Quality Control Manual;
b) The facility personnel possess ability to undertake the requirements described in Section 12.0; and
c) The calibration of the test equipment conforms to the requirements of the Quality Control Manual.

Each item shall be qualified prior to issuing grade stamps.

Note: *Delamination tests can be made on rough lumber provided delamination tests are performed on the finished product as well, and that the finished product results must be used for product quality control. This is meant to address the effect that planing may have on the fingerjoint.*

13.2 NEW PRODUCTION LINE START-UP OR MAJOR CHANGE REQUIREMENTS (To be performed by the Facility)

During start-up of a new production line or when a major change to the fingerjoint process occurs, the facility shall immediately notify the Agency. Prior to grade stamps being issued for lumber from the new production line or to continue grade stamping privileges in the case of a major change(s), the facility shall provide the Agency with test results of **53** specimens performed in flat-bending and **53** specimens in edge-bending using samples generated from two consecutive shifts of operation.

The **106**-specimen sample shall be tested in accordance with Section 9.1 and the test results shall satisfy the requirements set forth in Section 13.6.1.1.

The sample for these tests shall be obtained from a single size, consisting of the highest grade, a specific species or species combination and using a procedure, approved by the Agency, which ensures that the sample is representative of the item to be qualified.

The **106**-specimen joint test is required in the initial start-up of a fingerjoining line or when there is a major change to the fingerjoining process: it is intended to verify the adequacy of the joint profile chosen, and does not substitute for the Initial Qualification requirements called for in Sections 13.3 and 13.6.1.

Grade stamping shall be contingent upon verification of the item in accordance with Section 13.6.1 of this Standard.

13.3 INITIAL QUALIFICATION SAMPLING (To be performed by the Agency)

The agency supervisor shall randomly select the following samples for each grade to be qualified:

a) **53** specimens for the edge bending modulus of rupture (MOR) property evaluations to be tested in accordance with Section 9.1 of this Standard in such a way that the compression face is randomly generated;

b) **53** specimens for the flat-bending modulus of rupture (MOR) evaluations to be tested in accordance with Section 9.1 of this Standard in such a way that the compression face is randomly generated; and

c) **20** fingerjoint specimens for the delamination resistance tests. This sample may be extracted from the **53** flat or **53** edge bending specimens containing fingerjoints that were not tested in bending. The sample shall be tested in accordance with Section 9.2 of this Standard.

For items **a)** and **b)** above, additional specimens to increase the sample size to **78**, **102**, **125** or **148** pieces may be selected to qualify the fingerjoint bending strength.

Note: *When selecting additional specimens, the minimum sample size will depend on the property being evaluated. See Section 13.6.1.1(d).*

13.4 RE-QUALIFICATION SAMPLING

The minimum sample size for each item and for each property to be re-qualified is:

13.4.1 BENDING STRENGTH

a) When the 5th %ile edge-bending modulus of rupture is required to be re-qualified, **28** specimens shall be randomly selected. The sample shall be tested for edge-bending modulus of rupture in accordance with Section 9.1 of this Standard.

b) When the 5th %ile flat-bending modulus of rupture is required to be re-qualified, **28** specimens shall be randomly selected. The sample shall be tested for flat-bending modulus of rupture in accordance with Section 9.1 of this Standard.

c) When the minimum edge-bending modulus of rupture is required to be re-qualified, **53** specimens shall be randomly selected (see Section 13.6.2.1.2). The sample shall be tested for edge-bending modulus of rupture in accordance with Section 9.1 of this Standard.

d) When the minimum flat-bending modulus of rupture is required to be re-qualified, **53** specimens (see Section 13.6.2.1.2) shall be randomly selected. The sample shall be tested for flat-bending modulus of rupture in accordance with Section 9.1 of this Standard.

13.4.1.1 For Section 13.4.1, increasing the sample size to **53**, **78**, **102** or **148** pieces is permitted to re-qualify the modulus of rupture of the fingerjoints.

Note: *When selecting additional specimens, the minimum sample size will depend on the property being evaluated. See Sections 13.6.2.1.1(c) and 13.6.2.1.2(b).*

13.4.2 DELAMINATION

When the delamination resistance is required to be re-qualified, **20** fingerjoint specimens shall be randomly selected. The sample shall be tested for delamination resistance in accordance with Section 9.2 of this Standard.

Note: *Re-qualification tests are limited to those items that are deemed to be "**OUT-OF-CONTROL**".*

13.5 INSPECTION

Each qualification or re-qualification specimen shall meet the requirements in the joint area of the grade being qualified.

13.6 DECISION RULES

13.6.1 INITIAL QUALIFICATION RULES

Results of edge and flat-bending and delamination tests shall determine whether or not grade stamps may be issued for the item being qualified.

Note: *If the test results meet the delamination requirement above but do not meet all the other requirements, the manufacturer may elect to qualify for a lower grade.*

Alternatively, adjustments to the manufacturing process may be made; new samples selected and tested until the above requirements are satisfied.

An item shall be considered qualified when all the following requirements have been met:

13.6.1.1 BENDING STRENGTH

a) **"All"** of the **53**-specimen test results shall meet or exceed the **"minimum bending strength"** value as provided in Tables 4 to 7;

b) Not more than **1** of the **53**-specimen test results shall have an edge-bending strength less than the **"5th %ile bending strength"** value as provided in Tables 4 to 7;

c) Not more than **1** of the **53**-specimen test results shall have a flat-bending strength less than the **"5th %ile bending strength"** value as provided in Tables 4 to 7; and

d) When the additional specimen sampling procedure referred to in Section 13.3 is used to qualify for bending strength:

i) The number of test results below the "**minimum bending strength**" test value, as provided in Tables 4 to 7, shall not exceed **1** in a **102**-specimen sample or **2** in a **148**-specimen sample; and

ii) The number of test results below the **"5th %ile bending strength"** test value, as provided in Tables 4 to 7, shall not exceed **2** in a **78**-specimen sample; **3** in a **102**-specimen sample; **4** in a **125**-specimen sample; or **5** in a **148**-specimen sample.

13.6.1.2 FINGERJOINT DELAMINATION

13.6.1.2.1 Specimen Delamination Conditioning and Classification

A **20** test-piece delamination sample prepared in accordance with Section 9.2.1 shall be subjected to one (1) or, if required, three (3) delamination cycles following procedures outlined in Section 9.2.2 and their delamination results processed as follows:

a) After One (1) Cycle:

Test specimens with delamination of less than or equal to 5% shall be deemed as meeting the delamination resistance requirements of this Standard and do not require any further exposure to delamination cycles.

i) For Long-fingered (LF) Joints:

A long-fingered (LF) joint does **not** meet the delamination resistance requirements of this Standard if the delamination exceeds 15% on either test specimen. Additional exposure to delamination cycles is not required.

Note 1: *For LF delamination testing, a LF joint is prepared in accordance with Clause 9.2.1.1. The LF delamination is determined by the average of the delamination results found on each half of the test specimen taken from the same joint (the sum of the delamination found on each side of the joint divided by 2).*

ii) For Short-fingered (SF) Joints:

A short-fingered (SF) joint does **not** meet the delamination resistance requirements of this Standard if the delamination is **greater than 10%.** Additional exposure to delamination cycles is not required.

Note 2: *For SF delamination testing, a SF joint is prepared in accordance with Section 9.2.1.2. The SF delamination is that obtained from the single test specimen.*

Otherwise, the specimen(s) shall be subjected to two additional cycles for a total of three cycles.

b) After Three (3) Cycles:

i) For Long-fingered (LF) Joints:

A LF specimen does **not** meet the delamination resistance requirements of this Standard if the LF delamination (see *Note 1*) is greater than 10%, or if the delamination is greater than 15% on either half of the test specimen.

ii) For Short-fingered (SF) Joints

A SF specimen does **not** meet the delamination resistance requirements of this Standard if the delamination is greater than 10%.

Otherwise, the specimen shall be deemed as meeting the delamination resistance requirements.

13.6.1.2.2 Evaluation of Delamination Results

The delamination resistance requirements are deemed to have been met if at least **19** of the **20** specimens for delamination meet or exceed the delamination resistance requirements assessed in accordance with Section 13.6.1.2.1 of this Standard.

13.6.2 RE-QUALIFICATION RULES

13.6.2.1 BENDING STRENGTH

The fingerjoined lumber shall be considered re-qualified for bending strength properties when the following requirements are met:

13.6.2.1.1 5TH %ILE BENDING STRENGTH

a) As applicable, **"All"** of the **28**-specimen test results shall meet or exceed the **"5th %ile edge-bending strength"** value as provided for the grade in Tables 4 to 7.

b) As applicable, **"All"** of the **28**-specimen test results shall meet or exceed the **"5th %ile flat-bending strength"** value as provided for the grade in Tables 4 to 7.

c) When the additional samples referred to in Section 13.4 are used to re-qualify the 5th %ile bending strength, the number of test results below the **"5th %ile bending strength"** value as provided in Tables 4 to 7 shall not exceed **1** in a **53**-specimen sample; **2** in a **78**-specimen sample; or **3** in a **102**-specimen sample.

13.6.2.1.2 MINIMUM BENDING STRENGTH

a) As applicable, **"All"** of the **28**-specimen test results shall meet the **"5th %ile bending strength"** value as provided in Tables 4 to 7.

If this requirement is met, the process is considered re-qualified.

However, the sampling frequency shall be increased (doubled or tripled, etc.) and maintained until an additional **25**-specimen sample has been generated and tested for the bending orientation (edge-wise or flat-wise) that was found to be "**OUT-OF-CONTROL**".

"**All**" of the **25** additional test results shall meet or exceed the **"minimum bending strength"** value as provided in Tables 4 to 7.

b) When the additional samples referred to in Section 13.4 are used to re-qualify the minimum bending strength, the test results shall meet the following:

i) For a sample size of less than **102**, **"None"** of the test results shall have a bending strength less than **"minimum bending strength"** value as provided in Tables 4 to 7;

ii) Otherwise, the number of test results below the minimum shall not exceed **1** in a **102-**specimen sample or **2** in a **148-**specimen sample.

13.6.2.2 FINGERJOINT DELAMINATION

The fingerjoints shall be considered re-qualified for delamination resistance when the requirements of Section 13.6.1.2 are met.

13.7 SUBSEQUENT QUALIFICATION

13.7.1 NEW GRADES

Qualification sampling and testing as outlined in Section 13.3 are required for each new item. Test results shall satisfy the requirements of Section 13.6.1.

13.7.2 MAJOR CHANGES

The qualification procedures outlined in Section 13.2 shall be required for any major changes and/or process conditions, which in the opinion of the Agency may affect the quality of the product.

Note 1: *Major changes may include but are not necessarily limited to: any new adhesive, a change to the joint profile, fingerjoining of green or green-frozen lumber and/or producing a grade(s) that has higher design values than those initially qualified.*

Note 2: *Changes in size and/or species or species combinations is not considered a major change. Requirements set forth in Section 13.3 are intended to deal with size and/or species changes.*

13.8 NON-PRODUCTION OF QUALIFIED GRADES EXCEEDING ONE YEAR

13.8.1 GENERAL

When a qualified facility does not produce fingerjoined lumber for a period exceeding one year, and the Agency has confirmed that the requirements of Section 13.1.1 have been met and that a major change as defined in Section 13.7.2 has not occurred, resumption of fingerjoined lumber production is permitted after the requirements of Section 13.8.3 (CASE B) have been met. Otherwise, the requirements of Section 13.8.2 (CASE A) shall be met.

13.8.2 CASE A

13.8.2.1 All grade qualifications for that facility shall become void. The requirements for initial qualification shall be satisfied prior to further production of fingerjoined lumber.

13.8.3 CASE B

13.8.3.1 Prior to the resumption of production, the highest grade (e.g. highest test load requirements) of the **widest width** that the facility wishes to produce that was previously qualified and **IN-CONTROL**, shall be sampled and tested for bending strength and delamination resistance in accordance with Sections 13.3 and 13.6.

Note: *If a facility wishes, at a later date, to produce a wider width that was previously qualified and in-control, the highest previously qualified grade (e.g. highest test load requirements) for this width shall be sampled and tested for bending strength and delamination resistance in accordance with Sections 13.3 and 13.6.*

13.8.3.2 Subsequent to the resumption of production, edge- and flat-wise bending samples from two consecutive production shifts for the same grade and width evaluated in 13.8.3.1 shall meet the requirements of Section 13.4.1.

13.8.3.3 Delamination sampling shall revert to Level I.

14.0 EQUIPMENT CALIBRATION

Records of all calibration checks and spot-check verifications shall be maintained for at least six (**6**) years.

14.1 TEST EQUIPMENT

The test equipment shall be certified and calibrated by an independent certification organisation acceptable to CLSAB. This is to be done prior to initial qualification and once a year thereafter. Procedures for calibration of the test equipment shall be consistent with the applicable sections in ASTM E4, except that the percentage error shall not exceed ± 2.0%.

It is the responsibility of the facility to maintain the operating condition of its test equipment in accordance with requirements set forth in their Quality Control Manual and this Standard.

The test equipment calibration shall be spot-checked in accordance with procedures set forth in the Quality Control Manual and the spot check shall be performed at a frequency level listed in Table 8 and whenever there is reason to suspect the equipment may be out of calibration or damaged.

The Agency shall be notified immediately if damage to the test equipment or a spot check device has occurred. Re-calibration of the test equipment or spot-check devices by an independent certification organisation may be required by the Agency.

TABLE 8 - TEST EQUIPMENT SPOT CHECK FREQUENCY

Equipment	Minimum Spot Check Frequency
Bending Tester	At least once a week
Tension Tester	At least once a week
Other Test Equipment	As per manufacturer's specifications, the Quality Control Manual and/or SPS 1.

14.2 CALIBRATION DEVICES

An independent certification organisation acceptable to CLSAB shall certify and calibrate devices necessary to conduct the required spot-checks on the test equipment. This is to be done prior to initial qualification and once a year thereafter.

Procedures for the certification and calibration of calibration spot-check devices shall be consistent with applicable sections of ASTM E4 except that the percentage error shall not exceed ± 2.0%.

A copy of all certification documents shall be made available to the Agency.

15.0 QUALITY CONTROL REQUIREMENTS

15.1 QUALITY CONTROL PROCEDURES

The quality control procedures described herein are intended to detect non-conformance in the fingerjoints. The properties of the fingerjoints to be considered are edge and flat bending strength and delamination.

In addition, when applicable, all fingerjoints are required to be proof-loaded to a tension stress level as provided in Tables 4 to 7.

The quality control procedures used by a facility shall be fully documented in their Quality Control Manual.

Verification of product quality includes two independent procedures:

a) One dealing with the quality, strength and delamination of the fingerjoints; and

b) One dealing with the grade of the lumber containing fingerjoints. Verification as to the grade of the lumber shall follow the grading provisions set forth in the NLGA Grading Rules.

Note: *Delamination tests can be made on rough lumber provided delamination tests are performed on the finished product as well, and that the finished product results must be used for product quality control. This is meant to address the effect that planing may have on the fingerjoint.*

15.2 QUALITY CONTROL SAMPLING

15.2.1 SAMPLING METHOD

The sampling method shall be approved by the Agency and documented in the Quality Control Manual.

15.2.2 SAMPLING FREQUENCY FOR DAILY QUALITY CONTROL

The frequency of the sampling is stated in Sections 15.2.2.1, 15.2.2.2, and/or 15.2.2.3. Under exceptional circumstances, the Agency may request the facility to increase its frequency of inspection and/or testing.

15.2.2.1 TENSION PROOF LOADED ITEMS

At least one specimen for flat-bending test and one specimen for edge-bending test shall be obtained during each four **(4)** hours or part thereof of operation for production that is tension proof loaded.

15.2.2.2 NON-TENSION PROOF LOADED ITEMS

At least one specimen for flat-bending test and one specimen for edge-bending test shall be obtained during each two (**2**) hours of operation for production that is non-tension proof loaded with no fewer than five (**5**) specimens collected during any production shift of less than five (**5**) hours.

15.2.2.3 DELAMINATION SAMPLING

There are four stages of delamination sampling:

a) Delamination Sampling Following Qualification;
b) Level I Delamination Sampling;
c) Level II Delamination Sampling; and
d) Delamination Verification Sampling

a) Delamination Sampling Following Qualification

Immediately following initial qualification of a product, four fingerjoint specimens shall be obtained from each **half-shift**, or part thereof, of operation for at least 500 shifts.

These fingerjoints may be taken from specimens sampled for bending tests (refer to Section 9.2).

The delamination results shall be assessed in accordance with Table 9 to determine if verification sampling in accordance with 15.2.2.3(d) is required.

If after **500** shifts of performing delamination sampling and testing the data shows that the facility remained "**IN-CONTROL**" for the last **40** shifts of production, then the facility may go on to "Level II Delamination Sampling" and testing.

b) Level I Delamination Sampling

For Level I delamination sampling, four fingerjoint specimens shall be obtained from each **half-shift**, or part thereof. These fingerjoints may be taken from pieces sampled for bending tests (refer to Section 9.2). The delamination results shall be assessed in accordance with Table 9 to determine if verification sampling in accordance with Section 15.2.2.3(d) is required.

If after performing delamination sampling and testing the data shows that the facility remained "**IN-CONTROL**" for the last 40 shifts of production, then the facility may go on to "Level II Delamination" sampling and testing.

c) Level II Delamination Sampling

For Level II Delamination Sampling and testing, one fingerjoint specimen shall be obtained for each **half-shift**, or part thereof of operation. The delamination results shall be assessed in accordance with Table 9 to determine if verification sampling in accordance with 15.2.2.3(d) is required.

d) Verification Delamination Sampling

When verification sampling is required (see Table 9), an additional sample of **5** fingerjoint specimens shall be randomly selected from the half-shift of production.

When operating under Level II sampling, the 5 fingerjoint specimens shall be randomly taken from the second half-shift. The first half-shift shall be sampled if required by Section 15.4.2.2(a).

Note: *See APPENDIX IX for commentary on Table 9.*

15.3 QUALITY CONTROL TESTING

Testing for modulus of rupture, delamination and tensile strength shall be performed in accordance with the procedures described in PART A, Section 9 of this Standard.

15.4 ANALYSIS OF QUALITY CONTROL TESTS

Test results shall be entered on Agency approved control forms. The control forms shall be designed so that the process properties qualified under Sections 13.3 and 13.6.1 are recorded and "**IN-CONTROL**" and "**OUT-OF-CONTROL**" situations shall be readily detectable.

15.4.1 IN-CONTROL (Also see APPENDIX VI, VII & VIII)

When all of the process properties referred to in Sections 15.3 and 15.4 remain "**IN-CONTROL**", the item from which the quality control sample was drawn shall be deemed to be in compliance with the property requirements of this Standard.

TABLE 9 - HALF-SHIFT DELAMINATION RESULTS REQUIRING FURTHER VERIFICATION SAMPLING

Sampling Stage		Section 15.2.2.3	Joints Sampled per Half-shift	Number of Joints at the Delamination Level that Require Verification Sampling (Sec. 15.2.2.3 d)		All Other Cases
				> 5%	> 10%	
Following Qualification		(a)	4	4	1 or more	Verification sampling not required and half-shift of production is "**IN-CONTROL**"
Level I		(b)	4	4	1 or more	
Level II	*1st half-shift*	(c)	1	1 [1]	1	
	2nd half-shift	(c)	1	1 [2]	1	

[1] *Verification sampling pending and required only if specimen joint from 2nd half-shift shows delamination is greater than 5%.*

[2] *Verification sampling required only if specimen joint from 1st half-shift shows delamination greater than 5%, or if 1st half-shift is deemed to be "**OUT-OF-CONTROL**".*

15.4.2 OUT-OF-CONTROL

The requirements of this section relate to the conditions described in APPENDIX VI and APPENDIX VII.

When the process fails to meet the requirements specified in this Standard, the facility shall be deemed to be "**OUT-OF-CONTROL**" and the production as defined in Sections 15.4.2.1 or 15.4.2.2 shall be held pending the results of the following testing and analysis:

a) An examination of the test procedures, calibration and/or calculations shall be made to determine whether there were errors;

b) If no such errors are identified, proceed to Sections 15.4.2.1 and/or 15.4.2.2;

c) Held production deemed to be "**OUT-OF-CONTROL**" after evaluations in accordance with Sections 15.4.2.1 and/or 15.4.2.2 shall be rejected. The grade stamps from rejected production shall be obliterated or removed.

15.4.2.1 BENDING STRENGTH

When the production represented by a specific time frame from which the quality control sample was drawn fails to meet the bending strength requirements prescribed in Section 8.1, production from this time frame shall be held pending the results of bending tests on a twenty-eight (**28**) specimen sample for each of the bending orientation (edge-wise or flat-wise) that went "**OUT-OF-CONTROL**". These confirmation samples shall be randomly selected and tested in accordance with Section 13.4.

15.4.2.1.1 5th %ile Bending Strength

When an edge and/or flat bending test specimen falls below the **"5th %ile bending strength"** test value as provided in Tables 4 to 7 for the property tested, but not below the "**minimum joint strength**" value, the quality control edge and/or flat bending test specimen results of at least **27** of the next **28**-piece edge and/or flat bending tests shall meet or exceed the **"5th %ile bending strength"** value. Otherwise, the facility shall be deemed to be **"OUT-OF-CONTROL"**.

When the test results from **27** of the last **28** edge and/or flat bending specimens sampled in accordance with Section 15.2.2.1 or 15.2.2.2, as applicable, fail to meet the **"5th %ile bending strength"** requirements of Section 8.1.2, the confirmation samples shall be evaluated as follows:

- If the **28**-specimen flat bending and/or the **28**-specimen edge bending test results fail to meet the requirements of Section 13.6.2.1.1, the held production is "**OUT-OF-CONTROL**".

15.4.2.1.2 Minimum Bending Strength

When an edge and/or flat bending test sample result sampled in accordance with Section 15.2.2.1 or 15.2.2.2, as applicable, fails to meet the **"minimum bending strength"** value as provided in Tables 4 to 7, the confirmation samples shall be evaluated for the bending orientation that went "**OUT–OF-CONTROL**" as follows:

a) If the **28**-specimen flat bending and/or **28**-specimen edge bending test, as applicable, fails to meet the requirements of Section 13.6.2.1.2, the held production is "**OUT-OF-CONTROL**".

b) If the **28**-specimen re-qualification sample meets the "**5th %ile bending strength**" requirements of Section 13.6.2.1.2, the process is considered "**IN-CONTROL**" and the sampling frequency shall be increased (doubled, tripled, etc.) and maintained until an additional **25**-specimen sample has been generated and tested for the bending orientation (edge-wise or flat-wise) that was found to be "**OUT-OF-CONTROL"**.

c) **"All**" of the **25** additional test results shall meet or exceed the **"minimum bending strength"** value as provided in Tables 4 to 7 and not more than **1** of the test results shall be below the "**5th %ile bending strength"** value.

d) Otherwise, the process is deemed to be "**OUT-OF-CONTROL**" for the minimum edge-wise or flat-wise bending strength, whichever bending orientation is undergoing re-qualification.

15.4.2.2 DELAMINATION

a) If the average delamination of the **5**-piece verification sample (Section 15.2.2.3(d)) exceeds 10%, the half-shift of held production from which the samples were drawn shall be deemed to be "**OUT-OF-CONTROL**" for delamination.

b) When operating under Level II sampling, the first half-shift of production is permitted to be evaluated using verification sampling (Section 15.2.2.3(d)). Otherwise, the first half-shift of production shall also be deemed to be "**OUT-OF-CONTROL**" for delamination.

c) If the average delamination of the **5**-piece verification sample (Section 15.2.2.3(d)) is less than or equal to 10%, the half-shift of held production from which the samples were drawn, and the first half-shift of production if operating under Level II sampling, shall be deemed to be "**IN-CONTROL**" for delamination.

d) If **four or more** consecutive half-shifts of production are deemed to be "**OUT-OF-CONTROL**" for delamination, the process shall be deemed "**OUT-OF-CONTROL**" for delamination and shall be re-qualified for delamination as specified with Section 13.4.2.

15.5 ALTERNATE GRADES

As a result of the number of samples obtained for qualification, it is statistically possible to qualify a grade and subsequently find that it is not possible to maintain the fingerjoint requirements of the grade. In such a case, the facility, upon approval by the Agency, may wish to grade-stamp to a lower grade for which the quality control test requirements can be satisfied. This provision applies to Select Structural, No. 1 and No. 2 grades.

15.6 IDENTIFICATION AND TRACEABILITY

Each package of fingerjoined lumber leaving the facility production line shall be identified with the time and date it left the production line. This is to allow traceability of an item in the event further testing is required or in the event of a non-conformance or an "**OUT-OF-CONTROL**" condition.

15.7 QUALITY CONTROL RECORDS

Facility control records shall include but are not necessarily limited to:

a) Test equipment calibration and maintenance data;

b) Quality control tests; and

c) All fingerjoined production stoppages as a result of quality control requirements and a report of the corrective actions taken.

Separate records shall be maintained for each item produced.

All records shall include the date when performed and shall be retained for at least six (**6**) years.

These records shall be made available to the Agency upon request.

16.0 REINSPECTION PROVISIONS

16.1 GENERAL

Response to complaints on fingerjoined lumber involving visual grade, size, moisture content, tally, fingerjoints or assigned design values, shall be based on the applicable requirements within this section of the Standard, and by the requirements set forth in the NLGA Standard Grading Rules for Canadian Lumber (Section 1.2 of this Standard).

Sample selection and testing shall be performed by the Agency whose logo appears on the lumber (or by an independent accredited testing organization approved by the original grading Agency). Only certified test equipment calibrated to a national standard and using a process mutually agreed upon by the Agency, the seller, and the buyer shall be used.

16.2 JOINT ASSESSMENT SAMPLING AND EVALUATION

In the case of a dispute pertaining to fingerjoint strength assigned design values, a random sample of the item under complaint shall be obtained as follows:

a) **80** specimens for the edge bending modulus of rupture property evaluations to be tested in accordance with Section 9.1 of this Standard in such a way that the compression face is randomly generated;

b) **80** specimens for the flat-bending modulus of rupture evaluations to be tested in accordance with Section 9.1 of this Standard in such a way that the compression face is randomly generated.

Testing shall be undertaken in accordance with procedures set forth in Section 9.1 of this Standard using test equipment calibrated to a national standard and certified by an independent accredited testing organization.

Test results of the lumber in dispute shall be assessed as follows:

i) For the edge bending modulus of rupture, not more than **6** specimens out of **80** shall have an MOR value that is less than the corresponding 5^{th} %ile value as provided in Tables 4 to 7 for the grade and size.

ii) For the flat bending modulus of rupture, not more than **6** specimens out of **80** shall have an MOR value that is less than the corresponding 5^{th} %ile value as provided in Tables 4 to 7 for the grade and size.

For specimens that fail away from the joint at less than the 5^{th} %ile MOR value as provided in Tables 4 to 7, an equal number of replacement joints shall be selected and tested.

16.3 FINGERJOINT DELAMINATION SAMPLING AND EVALUATION

In cases of complaints pertaining to the fingerjoint delamination, a **20**-specimen sample representing the item shall be randomly selected.

Specimen preparation and testing shall be in accordance with Section 9.2 of this Standard.

If the delamination of any specimen or, if applicable, the average delamination of a specimen and its matching specimen (Section 9.2.1.1) after one vacuum, pressure and drying cycle exceeds 5% but is less than 10%, repeat the above vacuum, pressure, drying cycle twice on that specimen and its matching specimen (if any), and record the delamination at the end of the third cycle.

Not more than **2** joints shall show greater than 15% delamination.

APPENDICES

APPENDIX I - BENDING TEST SET-UP SCHEMATIC

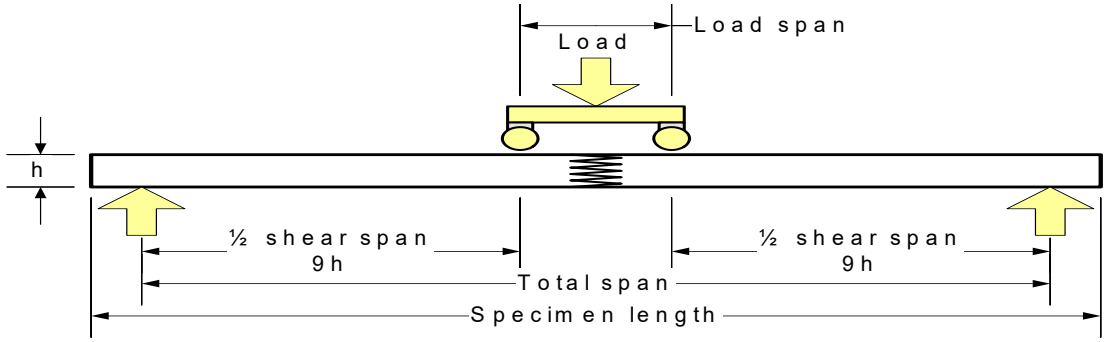


FIGURE 1 - BENDING TEST SET-UP SCHEMATIC

Example:

The specimen is a nominal 2x4 to be tested to determine the flat-wise bending strength of the fingerjoint. The fingers are 1 inch long.

Section 9.1.2 requires that the load points be placed approximately 2 inches from the fingerjoint, and that the shear span-to-depth ratio be between 15 and 20.

The following loading configuration is therefore used:

Test on flat (depth)	= 1.5"
Load span	= 5"
Shear span-to-depth ratio	= 18
Overhang (beyond supports)	= 4" each end

Shear span = 18 x 1.5 = 27";

1/2 shear span = 0.5 x 27 = 13.5";

Length = Shear span + Load span + (2 x Overhang);
= 27 + 5 + (2 x 4) = 40".

The **modulus of rupture** (MOR) is calculated using:

$$MOR = \frac{3Pa}{bh^2}$$

Where: ***P*** = the maximum load obtained in pounds;

a = half the shear span in inches;

h = the specified depth of the specimen in inches;

b = the specified breadth of the specimen in inches;

MOR = modulus of rupture in psi.

For the example shown, the calculations using inch-pound unit is as follows:

$$MOR = \frac{3P \times 13.5}{3.5 \times 1.5^2} = 5.14P$$

with ***P*** in lbs. and **MOR** in psi.

If the breaking load, ***P***, is 935 lbs., the **MOR** is 4,810 psi.

APPENDIX II - QUALITY CONTROL MANUAL CONTENTS

The Quality Control Manual (Plant Standard) is a written description of the manufacturing operation, broken down by station.

For each station in the sequence of manufacture, a description is required of the function performed by the equipment, the skills the operator requires, the responsibility of the operator in control of that station, and (if required) what checks are instituted to ensure that the equipment and operator are performing within the desired limits.

Examples of typical stations are:

a) **Input grading**: a station where defects are removed from the ends of the lumber prior to machining of the fingerjoint;

b) **Machining of the fingerjoints**: this station would be concerned primarily with set-up tolerances and criteria for changing cutter heads;

c) **Glue mixing**: this station would be concerned with measuring the prescribed proportions of adhesive and hardener, ensuring thorough blending at the prescribed temperature levels; and

d) **Make-up station**: this station may consist of top dead rolls mounted above the in-feed table (ahead of the crowder and retard system). It provides assistance to the operator with assembly of the joint.

The Quality Control Manual provides details of all test procedures used, the wood failure criteria used (if any) and the records to be kept of in-process checks that are made. The details of the Quality Control Manual will vary with the process used. Some aspects of it may be common to all lumber sizes, grades and species groupings, while other aspects may vary with size, grade and species.

An important part in the Quality Control Manual is special provisions for shut down and start-up of the gluing line, particularly during temporary stoppages. The latter is of particular significance in preheat processes, in which the glue may be spread on heated wood, and must be put under gluing pressure within a limited time to avoid pre-cure of the glue.

Another important section covers the provisions made for the absence of any operator with specialized skills essential to the process.

In general, the Quality Control Manual specifies, in writing, one or more sets of facility operating conditions that are known to result in a product that is in continuous conformance with the requirements of this Standard. The qualification applies only to product(s) produced within the specified limits of the Quality Control Manual.

APPENDIX III - THE USE OF WOOD FAILURE ASSESSMENT IN PROCESS CONTROL

In this Standard, control of the quality of gluing is based on resistance to delamination. However, the results from a delamination test take time. During the start-up, and during periods in which the manufacturing facility goes out of control for no obvious reason, assessing the wood failure developed in the fingerjoint may assess the quality of the glueline more rapidly. In processes using heat to accelerate the cure of the glueline, wood failure may be assessed within a short period after assembly of the glued joint, usually within 5 to 15 minutes. This wood failure assessment may be used as a diagnostic tool to identify malfunctions in the manufacturing process.

The significance of wood failure is that it correlates inversely with delamination resistance. If a high degree of wood failure develops, the joint should be resistant to delamination. Conversely, any area in the joint that shows no wood failure may be prone to delaminating in the delamination test.

In this Standard, wood failure shall mean that the joint fails in a shallow layer of the wood next to the glueline. In testing fingerjoints, the difficulty with a wood failure test procedure is a tendency for some of the fingers to break off at the base rather than pull out of the joint.

Such broken fingers are not classed as wood failure, but are indeterminate, since the glueline under the finger was not stressed in shear parallel to the glueline.

Another observation of interest is not wood failure, but glue failure. Ordinary glue failure is a failure in the glueline itself, so that glue is visible on both matching surfaces of the joint. In hot set joints made with phenol-resorcinol glue, a common cause is thick gluelines in which the glue boils out. This may result from inadequate pressure, which in turn may result from a slip in the roller press, improper machining of the joint, or from dirt in the joint which prevents the joint from squeezing together properly.

Another cause for glue failure is pre-cure of the glue in circumstances in which glue is spread on both ends of a heated fingerjoined piece. This pre-cure may affect the whole joint or may be restricted to areas in the joint that received an inadequate spread of glue as a result of glue wipe in the glue spreader.

Another type of failure is adhesion failure, in which the glueline fails not in the glueline, but at the surface of the wood. In such a failure, the glue is visible on one side of the glueline but the matching area on the other side of the glueline is bare wood or wood lightly stained by the glue. Common causes of this is pre-cure of the glue spread on one end of the piece of heated wood, due to either inadequate glue spread in all or part of the joint, or in holding the glue spread piece too long before assembly.

Both types of failure (cohesion failure and adhesion failure) must be distinguished from glue skip, in which a portion of the joint gluing surfaces receives no glue at all. This is not a glue failure; however, any such area may be vulnerable to delamination.

The technique used to open the joint with minimum breakage of the fingers is to fail the joint in bending at right angles to the line of the fingers: e.g. flat bending of a horizontal fingerjoint. The piece is subjected to a bending load until approximately half of the fingers on the tension face are pulled open. The piece is then turned over and a bending load again applied to pull open the remaining fingers. In hot set joints, less finger breakage is obtained if the joint is broken open as soon as the glue has hardened. It is particularly important that the entire joint be broken open in flat bending.

If the testing machine does not have sufficient displacement capacity, the partially failed joint can be broken completely open by resting it on two supports and applying sufficient force to pull open the joint.

Wood failure is not a mandatory requirement of this Standard. However, Section 7.4.1 requires that sufficient glue must be applied to the joint.

APPENDIX IV - AGENCY ADMINISTRATION

An accredited Agency shall administer this Standard. Agency approval of a facility to grade stamp fingerjoined lumber shall be contingent upon the facility's compliance with the procedures and requirements of this Standard.

Inspections shall include amongst other things reporting on the following:

a) Examination of specimens from the facility's inventory, the facility's records, and procedures, to verify compliance to the requirements of PART A of this Standard and the Quality Control Manual.

b) Examination of the bending and the proof loading equipment including observations on:

- **i)** wear and damage;
- **ii)** lubrication and operations of moveable parts;
- **iii)** record of weekly calibration

c) Examination of the delamination test equipment, including the apparatus for measuring temperature, pressure and time, and the drying chamber.

d) Inspection of the glue mixing equipment and procedures, including the accuracy of the weighing equipment, mixing proportions, and cleanliness of the facility.

e) Verification of the delamination measurement and procedures.

f) Examination of the control system used to prevent overheating of the wood in the gluing surface.

APPENDIX V - FINGER PROFILE ORIENTATION FOR DELAMINATION IN THE DRYING CHAMBER

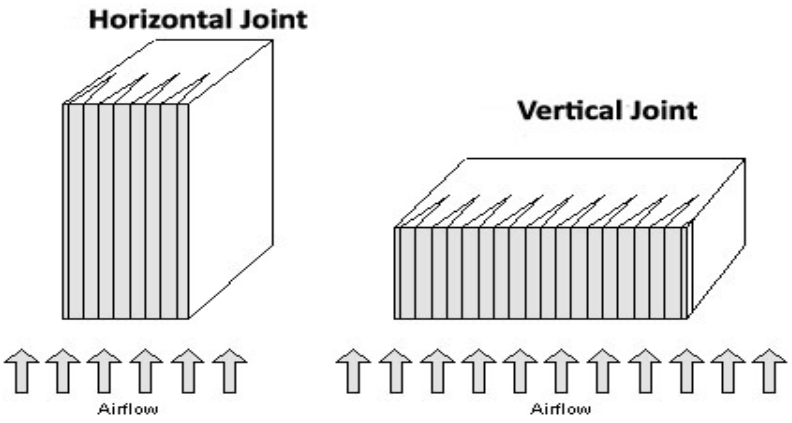


FIGURE 2 - FINGER ORIENTATION RELATIVE TO AIRFLOW

APPENDIX VI - EXAMPLES OF DELAMINATION "IN-CONTROL" & "OUT-OF-CONTROL" SCENARIOS

In-control - not more than 3 with delamination between 5 and 10% in any half-shift under Level I; and not more than 1 in both half-shift under Level II.

Out-of-control Level I - all samples between 5 and 10%; or one >10%. Each half-shift of production treated independently.

Out-of-control Level II - samples between 5 and 10% for both half-shifts, or occasional samples above 10%.

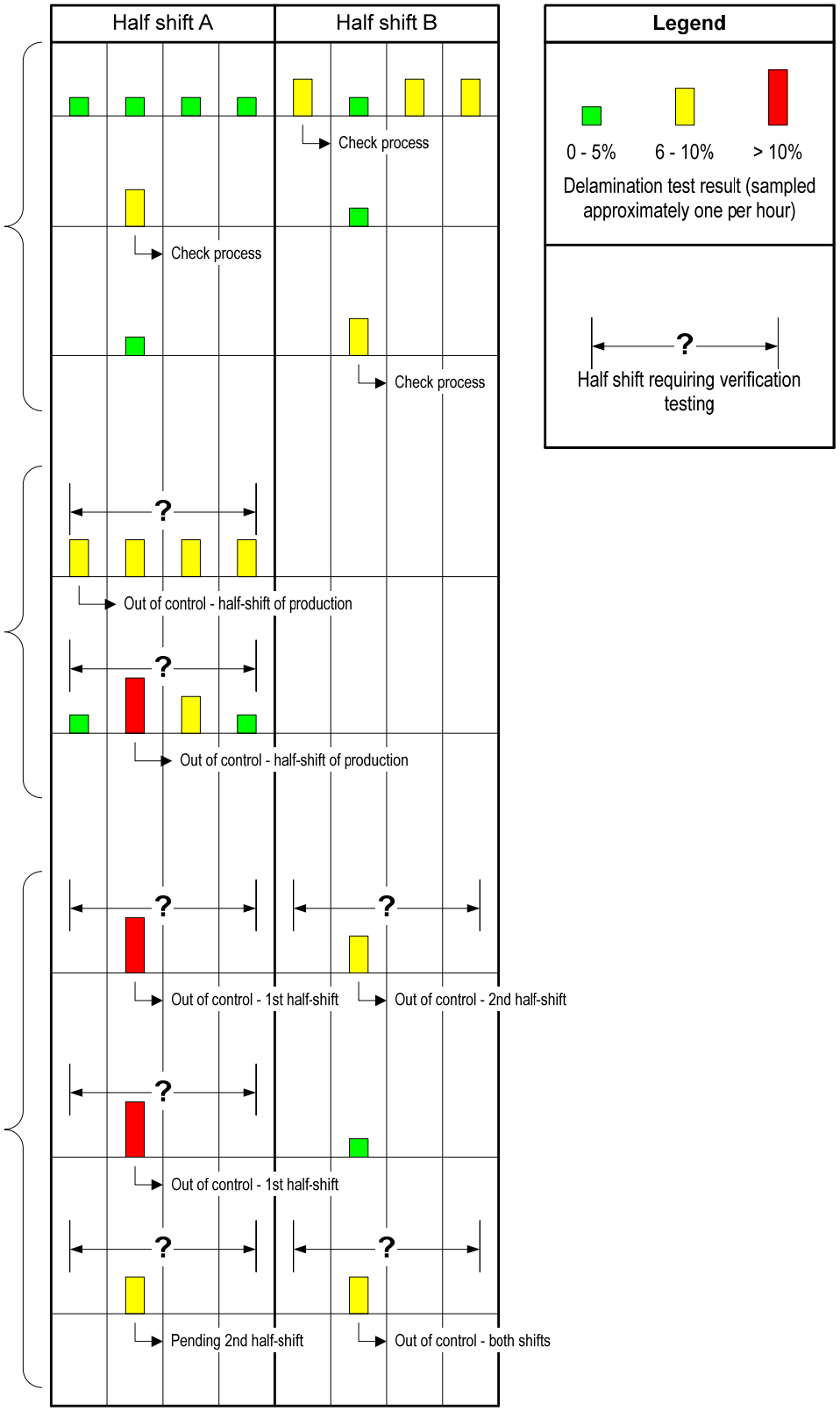


FIGURE 3 - EXAMPLES OF 'IN-CONTROL' AND 'OUT-OF-CONTROL' SCENARIOS

APPENDIX VII - FINGER JOINT VERIFICATION FLOW CHARTS: DELAMINATION

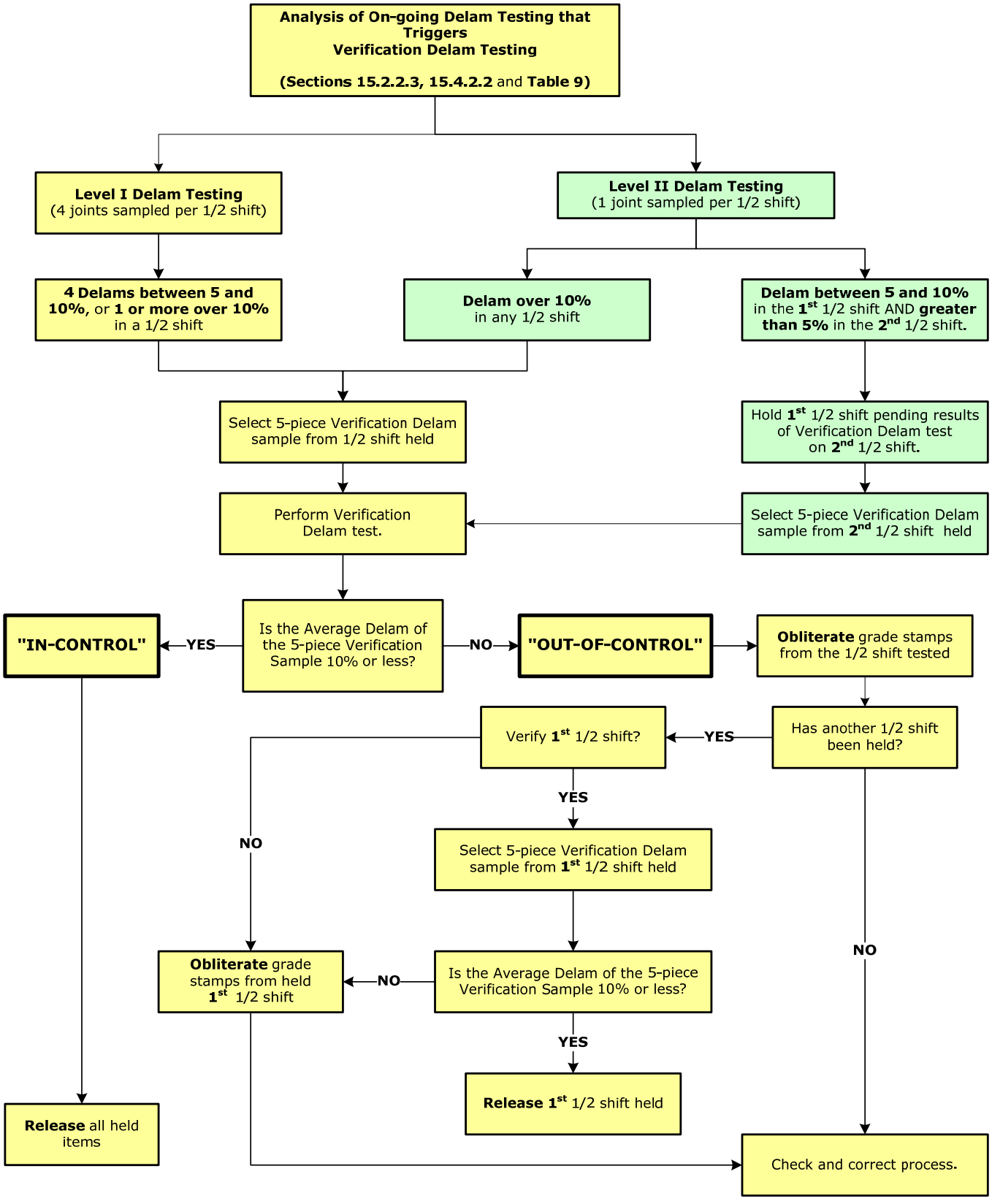


FIGURE 4 - DELAMINATION FINGERJOINT VERIFICATION FLOW CHART

APPENDIX VIII - FINGER JOINT VERIFICATION FLOW CHARTS: BENDING STRENGTH

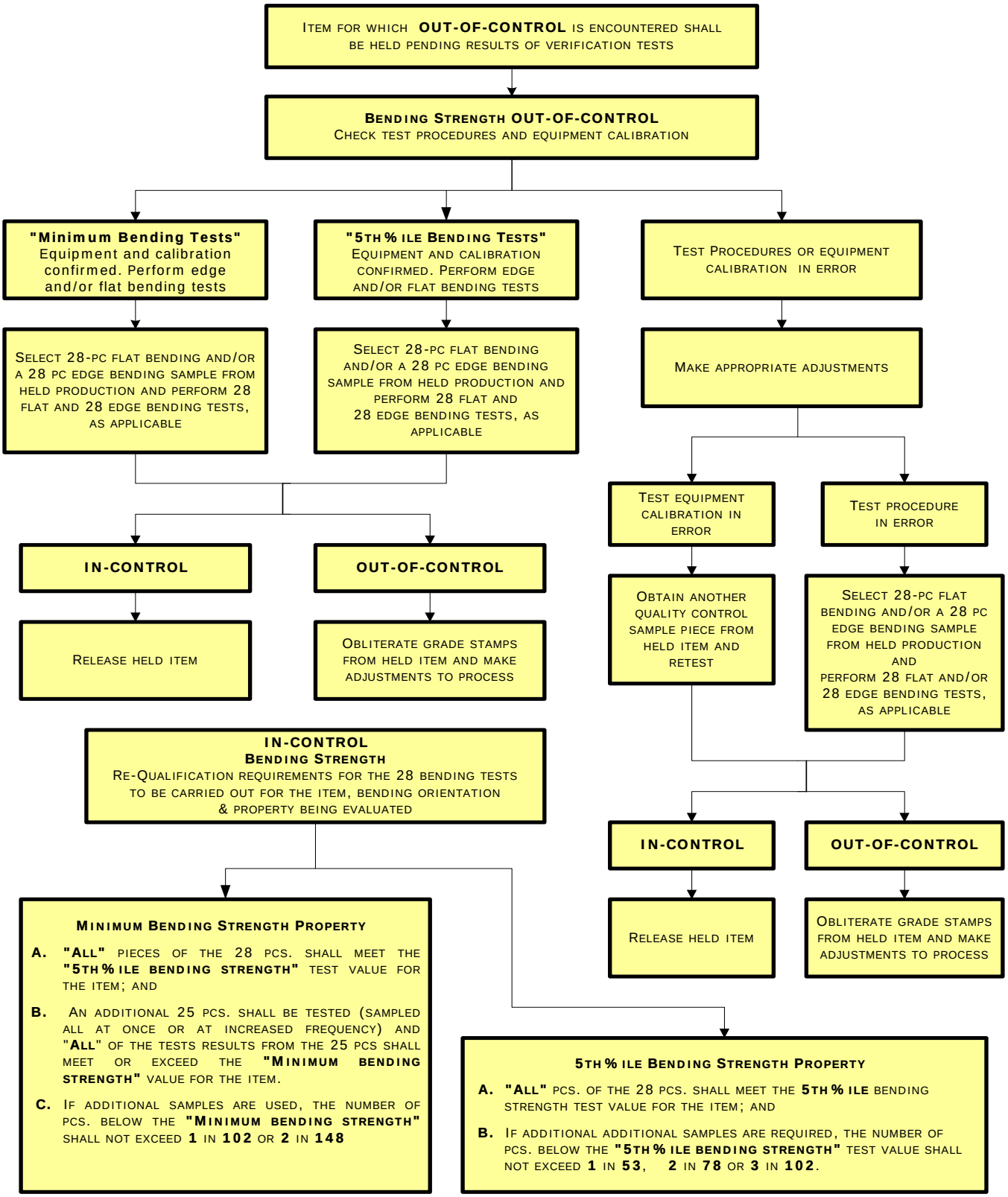


FIGURE 5 - BENDING STRENGTH FINGERJOINT VERIFICATION FLOW CHART

APPENDIX IX - COMMENTARY ON TABLE 9 - HALF-SHIFT DELAMINATION RESULTS REQUIRING FURTHER VERIFICATION TESTING

a) Evaluation of Delamination Results after Qualification
(Row 1 - Columns 4 & 5)

If following qualification and after one vacuum-pressure-dry cycle, all four fingerjoint specimens show average delamination greater than 5% but less than 10% (Column 4); **OR** one or more of the four fingerjoints show average delamination greater than 10% (Column 5), the half-shift production where the fingerjoint specimens were taken must be re-sampled for verification testing.

b) Evaluation of Level I Delamination Results
(Row 2 – Columns 4 & 5)

If under Level I delamination sampling and after one vacuum-pressure-dry cycle, all four fingerjoint specimens show average delamination greater than 5% but less than 10% (Column 4); **OR** one or more of the four fingerjoints show average delamination greater than 10% (Column 5), the half-shift production where the fingerjoint specimens were taken must be re-sampled for verification testing.

c) Evaluation of Level II - 1st Half-Shift Delamination Results *(Row 3 – Columns 4 & 5)*

If under Level II delamination sampling and after one vacuum-pressure-dry cycle, the single fingerjoint specimen taken in the **first** half-shift shows average delamination of 5% but less than 10% (Column 4), take no action but wait for the result of the **second** half-shift fingerjoint specimen. However, if the single fingerjoint specimen shows average delamination greater than 10% (Column 5), then the **first** half-shift production where the fingerjoint specimen was taken must be re-sampled for verification testing.

d) Evaluation of Level II - 2nd Half-Shift Delamination Results *(Row 4 – Columns 4 & 5)*

If under Level II delamination sampling and after one vacuum-pressure-dry cycle, the single fingerjoint specimen taken in the **second** half-shift also shows average delamination of 5% but less than 10% (Column 4); **OR** if the single fingerjoint specimen shows average delamination greater than 10% (Column 5), the **second** half-shift production where the fingerjoint specimen was taken must be re-sampled for verification testing. In addition, the **first** half-shift production must also be re-sampled for verification testing if it has not already been re-sampled under *Row 3* above.

General Instruction No. 1

NLGA - SPS 1

March 2017

NLGA Special Product Standard 1 (**SPS 1**) consists of **35 pages**; each dated **"March 2017"**

This Standard, like all NLGA Standards, is subject to periodic review, and may be amended from time to time.

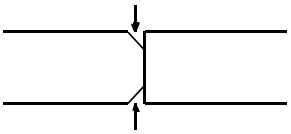
Check the publication section of the NLGA website (www.nlga.org) for the date of the latest edition.

SPS 1 and 3

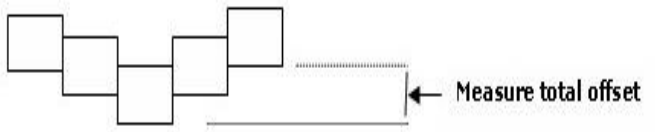
Questions
and
Ratified Responses

February 2021

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2002	**Section 1.5** (SPS 3) # of joints	**Q.** Is there a minimum or maximum number of joints permitted (required) in a SPS 3 product?	**A.** There is no restriction on the number of joints.
Sep 2002	**Section 1.5** (SPS 3) # of joints	**Q.** Was there ever a minimum or maximum?	**A.** There has never been a minimum or maximum. It would have been difficult to monitor and control. Instead, in the new ALSC policy, there is an assumed average segment length, which in the opinion of the task group represents a practical low limit for fingerjoined studs. The assumption is that the producer is dealing with random block lengths that average 12 inches in length (some blocks may be longer and some may be shorter).
Sep 2002	**Section 3.1** (SPS 3)	**Q.** Is a FJ stud a load-bearing member? Can it be used in exterior walls?	**A.** SPS 3 FJ lumber can be used in exterior walls but only in vertical (stud) applications. Some designers may not permit it to be used in exterior walls because of concerns with loss of structural integrity if there were a building envelope failure (i.e., leaky condos). If it is kept dry, structurally there is no difference between solid sawn and fingerjoined studs in a "vertical use" application.
Sep 2002	**Section 3.1** (SPS 3)	**Q.** Is the fingerjoined STUD grade stress rated?	**A.** SPS 3 FJ lumber is stress-rated. Generally speaking, the FJ STUD grade has the same set of design values as the solid-sawn STUD grade. Technically, in bending and tension, only the short-term loading (i.e., due to wind or earthquakes) design values for STUD grade applies to FJ STUD lumber. The long-term or normal loading values in bending and tension do not apply (treat as zero for FJ STUD). For compression (whether long-term or short-term) the design values for FJ studs are the same as for solid sawn STUD grade. The same applies to the other grades that can be produced under SPS 3 (such as NO. 2, Construction and Standard)
Jan 1994	**Section 3.1.2** Re-manning FJ lumber	**Q.** Can SPS 1 and 3 products be re-manned and re-grade stamped?	**A.** No. The NLGA SC agreed that there are no provisions for re-manning or re-grade stamping a fingerjoined product in SPS 1 & 3.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
May 2010	**Section 6.1 (SPS 1/3)**	**Q.** When a mill grade stamps a different species combination piece of FJ lumber under SPS 3, Clause 6.1 states "When species are joined from different species combinations, the design values for the lowest species shall apply. I would assume that the mill would then perform its FJ joint tests using the lowest species test value. Do you agree?	**A.** Yes, the SPS 3 test load would have to meet or exceed the test load required for the lowest species. There may be small anomalies if, for example, the tension-to-bending ratio of two species are such that one species has the lower tension strength while the other has the lower bending strength. In SPS 1, you may then find, for example, one species has the lower MOR test value, but the other species has the lower online tension proof load. Because the objective is to assess the quality of the fingerjoints, as opposed to the lumber, the test load level need only be the required flat-wise and edge-wise MOR for the lowest species and the on-line tension proof load associated with that species.
Aug 1998	**Section 6.2** Manufactured Holes (SPS 1/3)	**Q.** Posed to ALSC - Recently a question was raised concerning the evaluation of a "notch" in one side in a joint. The situation concerned one side of the joint being square and the other side of the joint having a $^3/_8$" equivalent triangle cut into each side of the piece on the end. The following drawing illustrates the joint.  $^3/_8$" notch sawn (manufactured) through each narrow face of one side of the joint.	**A.** Conversation with representatives of the rules writing agencies has indicated the "notch" is to be evaluated as a manufactured hole. The NGR Interpretations specify "the area of a manufactured hole shall not exceed the equivalent area of the knot hole permitted and is limited to one hole in 12' of length, or two in longer lengths." Thus, in the example, the piece of glued lumber would not be permitted in 12' and shorter "Vertical Use Only" or "Structural" fingerjoined lumber since the notches in one side of the joint develop two manufactured holes. The NLGASC unanimously ratified this interpretation.
Jun 1995		**Q**. Can the manufactured holes of the NGR Interpretations be in the joint area?	**A.** Yes, as per the NGR Interpretations**.**
Sep 2012	(Notching 2x4/2x6 FJ Lumber)	**Q.** A facility would like to add notches (no worse than a manufactured hole) for electrical wiring in FJ Studs used in non-load bearing walls.	**A.** Notches are not manufactured holes and should not be considered as such. If the notching is done after grade stamping at the request of a buyer, then this would come under buyer and seller agreement and would not involve NLGA.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Aug 1998	**Sect. 6.2.1.4 and 6.2.2.1** (SPS 3) **Sect. 6.2.2.1** (SPS 1) Pitch / Honeycomb	**Q.** It is of some people's opinion that pitch or honeycomb is permitted on one side of the joint up to 20% if the other side has no pitch or honeycomb. They feel that this is because the joint is profiled and when joined to the other piece it then only occupies 10% of the joint. Others feel that the 10% on the one side may reduce the glue bonding within the joint therefore these characteristics should be restricted to a maximum of 10% combined. Which is correct?	**A.** The wording in SPS 1 & 3 is quite specific to deal with honeycomb, pitch and knots. Refer to the Notes under Section 6.2.2.1 of SPS 1 and 6.2.1.4 & 6.2.2.1 of SPS 3. The 10% displacement refers to: only one piece of the joint; or the combination of the both pieces of the joint.
May 1996	**Sect. 6.2.1.2** (SPS 3) **6.2.1 and 6.2.2** (SPS 1) Unsound Wood	**Q.** Is soft rot permitted in the joint area of SPS 1/3 lumber?	**A.** Soft rot is not permitted in the joint area of SPS 1/3 lumber.
Sep 2005	***Note:** the phrase "No decay permitted in joint" was added to Section 6.2.1.2 of SPS 3*		
Sep 2005	**Sections 6.2.1.5 & 6.2.2.3** (SPS 3) Wane in Joint	**Q.** When wane in the joint of the two components for SPS 3 piece is not positioned on the same corner, is it off grade?	**A**. The piece would be on-grade for wane in the joint provided each piece (component) being joined meets the grade requirement for wane. (For stud, each component being joined would require ¾" of good wood at the ends being joined).
Sep 2003	**Sections 6.2.1.3 and 6.2.2.2** (SPS 3) **Section 6.2.3** (SPS 1) Knots	**Q.** If you see a knot or hole in the joint only on one side of the joint face because the other face is covered with the joined piece then should the knot be measured from one face and divide by 2 or measure from one face and this is the size of the knot?	**A.** Measure the knot on the one side of the joint and this will be the size of the knot. The assumption is that grain distortion associated with the knot will most likely extend past the base of the fingers and into the non-profiled cross-section. The weak section will be at the base of the fingers on the side containing the knot.
Jun 1995	**Section 6.2.3** (SPS 3) **Section 6.2.4** (SPS 1) Wane	**Q.** Can you have wane across the wide face equivalent to Skip as described in Para. 750 of the NLGA rules in the joint area?	**A**. Yes
Aug 1994		**Q.** Can you have Para. 750 wane extensions on the wide face in the joint?	**A.** Yes
Aug 1998	**Sect. 6.2.3** (SPS 3) **6.2.4** (SPS 1) Wane	**Q.** Are "wane dips" permitted in the joint area of SPS 3 lumber?	**A.** Wane dips are not permitted on the narrow face more than 1/2 the edge.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2003	**Section 6.2.2.5** (SPS 3) White Specks	**Q.** When 2 pieces each have white specks, how much white speck can you have in a joint and what is the knot size permitted in the joint?	**A.** 1/3 Volume and 2x4/2x6 - Max. 1", 2x3 - Max. 3/4" and 2x2 - Max. 3/8"
Jun 1995	**Section 6.5.1** (SPS 1 and 3) Tip Gap	**Q.** How is tip gap measured if it varies in width from edge to edge in the same joint?	**A.** $^{1}/_{16}$" maximum measured on the worst face.
Jun 1995		**Q.** What is the rational for the $^{1}/_{16}$" tip gap allowance?	**A.** It is good practice and allows for consistency of product. ***Note:*** *The purpose is to allow for squeeze out of excess glue and to prevent splitting at the base of the fingers during make-up.*
Aug 2001	**Sections 6.5.1 / 6.5.2** Tip Gap - Offset	**Q.** Are the tip gap and offset (Sections 6.5.1 and 6.5.2) requirements "zero tolerance" rules? Or is it only required that 95% or more of the samples not exceed the maximum offset limits?	**A.** These are "zero tolerance" rules.
Aug 1998 Revised **Aug 2001**	**Section 6.5.2** Off-set in the joint	**Q.** How is this clause interpreted**?**	**A.** The maximum offset permitted is 1/16", therefore the offset for each side of the joint could be 1/16" - not a total of 1/16" on both sides of the joint.
Sep 2005		Added diagram: 	
Nov 2016	**Section 9.1.1.1** (SPS 1 and 3) MOR Specimen Size	**Q.** In SPS 1 and 3, Section 9.1.1.1, the MOR specimen overhang is limited to a minimum 4" and a maximum 10". Is a shorter overhang permitted for the MOR evaluation of a fingerjoint?	**A.** Yes, a shorter overhang is permitted for MOR evaluation of a fingerjoint, provided the overhang extends sufficiently beyond the reaction points (i.e. pivot points) to prevent the specimen from slipping off the reactions before the ultimate load has been achieved.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2003	**Section 9.1.1.2** (SPS 1 and 3) Shear Span-to-depth ratio	**Q.** The mill's machine requires ripping the edge samples in half. Thus, the 2x6 edge bending test will be the longest span. Ripped in half, this will be a 2-3/4" wide piece, which will require a minimum span of about 46" between reaction points, plus 8" of overhang, for a total specimen length of 54". The machine cannot accommodate a piece this long. Is there any way to reduce the shear span-to-depth ratio or take an adjustment? Or, can the mill rip the 2x6 into two 2" pieces and average those?	**A.** You can reduce the span and have the 3rd party provide the correction factor.
Nov 2014	**Section 9.1.1.2** (SPS 1 and 3) Reduced Width MOR Specimen	***Note:*** *Section 9.1.1.2 in SPS 1 and 3 was replaced with "Reduced Width MOR Specimen" providing for a nominal 2x4 to be ripped length wise from the full-width test piece and applying a specified reduced-width factor to the edge-wise bending result.*	
Jan 1994	**Section 9.2** (SPS 1 and 3) Delamination Test Specimen	**Q.** Can you perform delamination tests on rough lumber?	**A.** Yes, provided delamination tests are performed on the finished product as well, and that the finished product results must be used for product quality control. The NLGASC was concerned about the possible effect of planing on the fingerjoint.
Sep 2005	**Note:** A note was added to Sections 13.1.1 of SPS 1 & 3 to address delamination test on rough lumber as noted in the response above.		
Jan 1994	**Section 9.1** (SPS 3) Rough Lumber	**Q.** Will section 9.1 allow you to perform bending tests on rough, dry fingerjoined lumber and plane it to size after the lumber has passed the tests?	**A.** Yes, provided an independent test agency verifies your proof loader test loads. Periodic proof load testing should be performed on the fingerjoined (FJ) lumber to show there is a relationship between the rough and dry FJ lumber performance. Product quality control tests shall be performed on the finished product. Again, the NLGASC was concerned about the possible effect of planing on the fingerjoint.
Sep 2003	**Sec. 9.3.2.2** (SPS 3) **Sec. 9.4.2.2** (SPS 1) FJ Test Specimens	**Q.** Is there any requirement for how long the mill has to wait (either a maximum time or a minimum time) to test production? Obviously, they want to leave some time for the glue bond to form. Does it matter how long they wait?	**A.** No, provided the stock is not shipped until the test is verified. It's important to make sure test specimens are stored under the same environmental conditions as the production until the start of bending tests.
Sep 2003	**Section 13.1.1** Initial Qualification	**Q.** If the mill is running 2x4 and 2x6, do both sizes have to be certified?	**A.** Yes, each item must be qualified.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2003	**Section 13.2** Major Change (To be Performed by the Facility)	**Q.** If the mill is running several species, can you certify the densest species only, like the WWPA procedures allow, or certify all species?	**A.** You only need to certify the densest species.
May 2005		**Q.** What about grade, if you qualify the highest and densest grade, do you have to re-qualify lower grades?	**A.** No, however separate records need to be maintained for each item.
May 2010		**Q.** After a major change (new glue) must a facility re-qualify all grades and sizes?	**A.** Yes. It was noted that some new adhesive technologies involve different glue application/mixing systems or claim to enable production to take place under more extreme conditions. Such systems may warrant an evaluation involving different sizes and will require some judgement in determining the scope of the re-qualification.
Sep 2004	**Section 13.2** (SPS 1 and 3) Major Changes	**Q.** If the mill is running 2x4 and 2x6, do both sizes have to be certified?	**A.** Do not confuse the Major Change 106-piece test (Section 13.2) with the initial qualification test (Section 13.3). The 106-piece test is required for Major Change and is only required on the highest grade and strength; however, the 53 / 53 initial qualification tests are required for each item (2x4 and 2x6).
Sep 2003	**Section 13.6** (SPS 1 and 3) Decision Rules	**Q.** When testing our daily QC samples for SPS 1 and 3, can we simply proof load pieces to the required levels (Min. & 5%ile) and then stop?	**A.** The Standards do not require that the joints be tested to destruction. However, it is probably good practice and useful for troubleshooting to test to destruction and note the mode of failure and percentage wood failure.
May 2019	**Section 13.7.2** (SPS 1 and 3) Major Changes	**Q.** If a switch from one joint profile is made to a different joint profile (but one that had been previously qualified two to three years prior), is there a requirement for a subsequent qualification as stated in Section 13.7.2?	**A.** No. Section 13.7.2 specifies that qualification procedures are only required for "…any major changes and/or process conditions which, in the opinion of the Agency, may affect the quality of the product". The SC agreed that, in this case, the opinion of the Agency would cover the scenario.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2004	**Section 13.8** Non-Production of Qualified Grades	**Q1.** One of our SPS 3 producers has shut the line down for what may be an extended period of time. Say six months. During our monthly visits, is there any need to check the calibration on the load cell, or would we only check it if the mill has produced. What about the weekly calibrations by the facility?	**A.** If the FJ line is shut down then it is not necessary for them to do calibration checks - Only when they start up again. Remember, if the FJ line is shut down for a year or more (Section 13.8) then a total re-qualification is required.
Sep 2004	**Section 13.8** Non-Production of Qualified Grades	**Q2.** When a facility does not produce fingerjoined lumber for a period exceeding one year, all grade qualifications for that facility shall become void. However, this facility had never stopped producing fingerjoined lumber, they just stopped grade stamping. Does the phrase "does not produce" mean "does not stamp". If it does, does the facility have to sample for the delamination test every hour or every 4 hours?	**A.** If the facility did not keep records for FJ for the last year then the initial qualification requirements need to be followed. With regards to Delam samplings, Level 1 delamination testing (one per hour for 40 shifts) should be taken.
Jul 2010		***Note:*** *The SPS 1 & SPS 3, Section 13.8 – Non-Production of Qualified Grades was revised in 2010.*	
Sep 2003	**Section 14.1** (SPS 1 and 3) Test Equipment	**Q.** The standard requires WEEKLY calibration of the equipment. What is the intent here – does the mill have to buy a proving ring and calibrate using this method weekly, or are there other ways this can be accomplished?	**A.** Interpret the same as with SPS 2 for off-line equip - It's up to the 3rd party to verify the procedure. Ask the 3rd party to provide you an acceptable practice (a load cell may be necessary). A bar (calibrated by a 3rd party) and dial & pressure gauges are used by some mills and Agencies. The intent is to confirm the MOR setting.
Feb 2013		***Note:*** *the term "Calibration" in SPS 1, Table 8 and SPS 3, Table 6 was replaced with "Spot Check" when specifying the frequency for checking the test equipment.*	

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2005	**Sections 14.1 and 14.2** (SPS 1 and 3) Calibration of Test Equipment and Calibration Devices	**Q.** Is it necessary for the calibration agency to go on-site to calibrate the test equipment?	**A.** Yes. Test equipment (Sec. 14.1) and calibration devices (Sec 14.2) such as weights and bars for spot checks need to be certified by an independent organization acceptable to CLSAB every year. Whether the "certification" actually involves calibrating the device/equipment against a traceable standard, is at the discretion of the independent organization. What is required by the standard is that the independent organization certifies the accuracy of the device/equipment. If the device or equipment requires calibration, then the calibration is required to be done in accordance with the applicable ASTM Standard.
May 2018	**Sec. 15.2.2** (SPS 3) Sampling Frequency for Daily Quality Control	**Q.** For the following scenarios, SPS 3 Studs and Delamination Sampling Level 1, in a facility running 8-hour shifts: a) Ran 7 hours on 2x6 and 1 hour on 2x4, or b) Ran 7.5 hours on 2x6 and 0.5 hours on 2x4. What would the correct number of MOR and Delam specimens for the 2x4 be? In the second scenario, is there anything that prevents all the sampling for the day being done on the 2x6 only?	**A.** What is foremost in this situation is that the required number of QC specimens are still taken in the half-shift **and** that each item is sampled. The intent is that each item (in this case, size) is sampled for QC. In both scenarios, in the second half-shift, the facility must sample the required QC specimens in proportion to the half-shift time production of the 2x6 and 2x4 items, with a minimum of at least one QC specimen per item.
Sep 2004	**Sec. 15.2.2.2** (SPS 3) **Sec. 15.2.2.3** (SPS 1) Delamination Sampling	**Q.** When there is a change of glue in SPS 1, 3, or 4 and because this is considered as a major change, does a mill have to move back to Level I delamination testing?	**A**. It is important to establish a delam conformance over time before returning to Level II delam sampling. If a mill has already performed the 500 shift delam requirement following initial qualification then when a company changes glue (Major change), the mill must revert to Level I delam QC but once they are In-Control for 40 shifts they may return to Level II delam QC. This also applies to Out-of-Control situations.
Jun 2006		**Q.** If a 1/2 shift is more than 4 hours, say 5 hours, how would one interpret Table 7 in SPS 3?	**A.** A half shift could be 4 or 5 hours depending on how long the shift is in a facility and Table 7 would apply to either 4 or 5-hour half-shifts.
May 2016		**Q.** We know that 4 specimens must be taken for delamination in each half shift regardless of how short that half shift may be, how about an half shift that has 5 or 6 hours, how many samples must be taken? Is it 4 as well?	**A.** A "half-shift" is 4 to 5 hours based on half of a full 8 to 10-hour production shift. For full shifts greater than 10 hours, "half-shifts" are defined as a maximum of 4 hours in length, so for example, a full 11 or 12-hour production shift would have 3 sets of "half-shifts". In all cases Table 7 is used to determine the number of samples per "half-shift" depending on the sampling stage.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
Sep 2003	**Section 15.4.2.1** (SPS 1 and 3) QC Bending Strength	**Q.** Now that we are looking at 5%-tile values, I want to make sure we are figuring the 5th %tile correctly. For qualification, not more than 1 piece is allowed to be below the tabulated 5th %tile value. Simple enough. What about the daily QC – how are you calculating the 5th %tile value from the daily QC test results?	**A.** Use Tables 2 to 5 - 5th %ile values for the species. (See Section 15.4.2.1.1)
Sep 2003	**Section 15.4.2.1.1** 5th %ile Bending Strength	**Q1.** Does this refer to the test results of the next 28 bending tests (regardless of dimension), or does it refer to the next 28 bending tests "of that item"?	**A.** It refers to the next 28 bending samples regardless of size from that production line.
		Q2. What is the intent of this section?	**A.** The intent is to assure that, over time, 95% of the pieces meet the 5th %ile value - thus we track the 5th %ile over the next 28 samples.
		Q3. "If the 28-specimen....., then the held production is "OUT-OF-CONTROL". Is the held production taken for the time block where the second 5th %ile failure occurred?	**A.** Yes. (See Note below)
Sep 2005	***Note:*** *The answer to Q3 above is superseded by the revision to Section 15.4.2.1 of SPS 1 and 3.* *The response to Q3 should now read that: 27 of the next 28 pieces (any size) need to meet the 5th %ile value or you are out-of-control and the* ***OUT-OF-CONTROL*** *held production sample is taken from the time period when the 5th %ile production went* ***OUT-OF-CONTROL****.*		
May 2010	**Section 15.4.2.2** Delamination	**Q.** If you are "OUT-OF-CONTROL" for Delam when at Level 2 Delam QC, do you have to revert to Level 1 Delam QC for 40 shifts?	**A.** Yes ***Note:*** *see ATTACHMENT 1 for the Example of Sampling Procedures*
May 2014	**Appendix VI**	**Q.** If Level I Half-Shift B is considered "IN-CONTROL", in any Half-Shift, can this Half-Shift B continue to be repeated two or more times consecutively without having to achieve Level I Half-shift A at any particular interval?	**A.** Yes, but the mill facility will likely eventually have a problem.

SPS 1 AND 3 – FINGERJOINED LUMBER QUESTIONS AND RATIFIED RESPONSES			
DATE ISSUED / RATIFIED	**CLAUSE NO.**	**QUESTIONS**	**RATIFIED NLGA RESPONSE**
May 2014	**Appendix VII**	**Q1.** When a 5-piece verification delam sample is required and is drawn from the 1/2 shift held, are the specimens drawn from different time frames spread out over that 1/2 shift or are the specimens pulled from the particular time frame where the non-compliant Level I delam test specimen(s) was found.	**A.** Preferably the specimens should be taken from around the time of the non-compliance but they can be spread over the 1/2 shift and randomly sampled.
		Q2. When an "OUT-OF-CONTROL" situation is verified after delam re-testing, is the entire 1/2 shift of production held for stamp obliteration, or is only those specific production bundles within the 1/2 shift held for stamp obliteration that exceeded 10% delam as a single specimen on the re-test?	**A.** Technically the full 1/2 shift, however if a mill chooses to break the 1/2 shift down into one hour segments within the 1/2 shift and conduct extra verification sampling for each hour to isolate the problem area then the grade stamps would only have to be removed from the portion identified as OUT-OF-CONTROL. Re-qualification (Section 13.4) must be conducted for either case to assure the product is back IN-CONTROL.
		Q3. What is the maximum percentage of delam is allowed on any single specimen while maintaining the appropriate 10% or less average? Can any single specimen on the re-test be 12%..15% or more?	**A.** Average is average. They can be over 15% but the risk of a problem in the market place increases – see Sections 13.6.1.2 & 16.3 that restrict the 15%.
May 2014	**Appendix VIII**	**Q.** When OUT-OF-CONTROL for bending strength is verified, how much of the item is held? ...a whole 1/2 shift of the item? ...only bundles from a certain time frame?	**A.** The full 1/2 shift but as noted above if the mill facility wants to try to isolate the problem time-frame they can. In either case, re-qualification (Section 13.4) must be conducted to assure the product is back IN-CONTROL.

ATTACHMENT 1 **OUT-OF-CONTROL Sampling Example**

SPS 1 and 3, Section 15.4.2 **(Updated March 2017)**

FINGERJOINT SAMPLING PROCEDURES FOR DETECTING "OUT-OF-CONTROL"

The following example is intended to promote uniform interpretation of SPS 1 or SPS 3 fingerjoint lumber QC sampling using typical "**OUT-OF-CONTROL**" situations.

Legend: **X** - Specimen Selected ✔ - Test Performed **O** - Denotes Failure

Line #	Shift	Time	Delamination			Edge Bending			Flat Bending		
			Specimen	Check >5%	Check >10%	Specimen	Check Min	Check 5th %	Specimen	Check Min	Check 5th %
1	Day 1st ½ Shift	9:00 a.m.	X	✔	✔	X	✔	✔ - O	X	✔	✔
2		10:00 a.m.	X	✔	✔						
3		11:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
4		12:00 p.m.	X	✔	✔						
5	Day 2nd ½ Shift	1:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
6		2:00 p.m.	X	✔	✔						
7		3:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
8		4:00 p.m.	X	✔	✔						
9	After Noon 1st ½ Shift	5:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
10		6:00 p.m.	X	✔	✔						
11		7:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
12		8:00 p.m.	X	✔	✔						
13	After Noon 2nd ½ Shift	9:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
14		10:00 p.m.	X	✔	✔						
15		11:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
16		12:00 a.m.	X	✔	✔						
17	Night 1st ½ Shift	1:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
18		2:00 a.m.	X	✔	✔						
19		3:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
20		4:00 a.m.	X	✔	✔						
21	Night 2nd ½ Shift	5:00 a.m.	X	✔	✔	X	✔	✔ - O	X	✔	✔
22		6:00 a.m.	X	✔	✔						
23		7:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
24		8:00 a.m.	X	✔	✔						
25	Day 1st ½ Shift	9:00 a.m.	X	✔	✔	X	✔ - O	✔	X	✔	✔
26		10:00 a.m.	X	✔	✔						
27		11:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
28		12:00 p.m.	X	✔	✔						

Legend: **X** - Specimen Selected ✔ - Test Performed **O** - Denotes Failure

Line #	Shift	Time	Delamination			Edge Bending			Flat Bending		
			Specimen	Check >5%	Check >10%	Specimen	Check Min	Check 5th %	Specimen	Check Min	Check 5th %
29	Day 2nd ½ Shift	1:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
30		2:00 p.m.	X	✔ - O	✔ - O						
31		3:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
32		4:00 p.m.	X	✔	✔						
33	After Noon 1st ½ Shift	5:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
34		6:00 p.m.	X	✔	✔						
35		7:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
36		8:00 p.m.	X	✔	✔						
37	After Noon 2nd ½ Shift	9:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
38		10:00 p.m.	X	✔	✔						
39		11:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
40		12:00 a.m.	X	✔	✔						
41	Night 1st ½ Shift	1:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
42		2:00 a.m.	X	✔ - O	✔						
43		3:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
44		4:00 a.m.	X	✔	✔						
45	Night 2nd ½ Shift	5:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
46		6:00 a.m.	X	✔ - O	✔ - O						
47		7:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
48		8:00 a.m.	X	✔	✔						
49	Day 1st ½ Shift	9:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
50		10:00 a.m.	X	✔	✔						
51		11:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
52		12:00 p.m.	X	✔	✔						
53	Day 2nd ½ Shift	1:00 p.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
54		2:00 p.m.	X	✔ - O	✔						
55		3:00 p.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
56		4:00 p.m.	X	✔ - O	✔						
57	After Noon 1st ½ Shift	5:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
58		6:00 p.m.	X	✔	✔						
59		7:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
60		8:00 p.m.	X	✔	✔						

30
51
52

Legend: **X** - Specimen Selected ✔- Test Performed **O** - Denotes Failure

Line #	Shift	Time	Delamination			Edge Bending			Flat Bending		
			Specimen	Check >5%	Check >10%	Specimen	Check Min	Check 5th %	Specimen	Check Min	Check 5th %
61	After Noon 2nd ½ Shift	9:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
62		10:00 p.m.	X	✔	✔						
63		11:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
64		12:00 a.m.	X	✔	✔						
65	Night 1st ½ Shift	1:00 a.m.	X	✔	✔	X	✔	✔	X	✔ - O	✔
66		2:00 a.m.	X	✔	✔						
67		3:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
68		4:00 a.m.	X	✔	✔						
69	Night 2nd ½ Shift	5:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
70		6:00 a.m.	X	✔	✔						
71		7:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
72		8:00 a.m.	X	✔	✔						
73	Day 1st ½ Shift	9:00 a.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
74		10:00 a.m.	X	✔ - O	✔						
75		11:00 a.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
76		12:00 p.m.	X	✔ - O	✔						
77	Day 2nd ½ Shift	1:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
78		2:00 p.m.	X	✔ - O	✔						
79		3:00 p.m.	X	✔ - O	✔ - O	X	✔	✔	X	✔	✔
80		4:00 p.m.	X	✔	✔						
81	After Noon 1st ½ Shift	5:00 p.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
82		6:00 p.m.	X	✔ - O	✔						
83		7:00 p.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
84		8:00 p.m.	X	✔ - O	✔						
85	After Noon 2nd ½ Shift	9:00 p.m.	X	✔	✔	X	✔	✔	X	✔	✔
86		10:00 p.m.	X	✔ - O	✔						
87		11:00 p.m.	X	✔ - O	✔	X	✔	✔	X	✔	✔
88		12:00 a.m.	X	✔ - O	✔ - O						
89	Night 1st ½ Shift	1:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
90		2:00 a.m.	X	✔	✔						
91		3:00 a.m.	X	✔	✔	X	✔	✔	X	✔	✔
92		4:00 a.m.	X	✔	✔						

Legend: **X** - Specimen Selected ✔ - Test Performed **O** - Denotes Failure

Line #	Shift	Time	Delamination			Edge Bending			Flat Bending		
			Specimen	Check >5%	Check >10%	Specimen	Check Min	Check 5th %	Specimen	Check Min	Check 5th %
93	Night 2nd ½ Shift	5:00 a.m.	x	✔	✔	x	✔	✔	x	✔	✔
94		6:00 a.m.	x	✔	✔						
95		7:00 a.m.	x	✔	✔	x	✔	✔	x	✔	✔
96		8:00 a.m.	x	✔	✔						

Summary of Actions

Lines 1 / 2: **See Section 15.4.2.1.1 for appropriate action**:

When an edge and/or flat bending specimen test fails between the **"5th %ile bending strength"** value and the **"minimum bending strength"** value as provided in Tables 4 to 7 for SPS 1 or Tables 2 to 5 for SPS 3, as applicable, and an examination of the bending test procedures confirms that there is no error in the calibration, test procedures or calculations; the quality control edge and/or flat bending test specimen results of at least twenty-seven (**27**) of the next twenty-eight (**28**) edge and/or flat bending tests must meet or exceed the **"5th %ile bending strength"** value. Otherwise the facility shall be deemed to be **"OUT-OF-CONTROL**".

Note: *Edge and flat bending test results are treated independently*

Lines 21 / 22: When a second failure occurs below the **"5th %ile bending strength"** value within the **28**-specimen sample period, the following action must be taken:

i) An examination of the bending test procedures shall be made to determine whether there were errors in calibration, test procedures and/or calculations;

ii) If no such errors are identified, the production from which the last quality control sample was taken shall be re-sampled to obtain a further twenty-eight (**28**) specimen sample for edge and/or flat bending tests as specified in Section 15.4.2.1.1. If the results from the bending tests fail to meet the requirements of Section 13.6.2.1.1, the production identified to be **"OUT-OF-CONTROL"** shall be rejected and the grade stamps shall be obliterated or removed.

- For the example provided, a second 5th %ile edge failure occurred between 5:00 a.m. and 6:00 a.m. of the tenth half-shift within the **28**-specimen sample period. This triggers the action that the FJ production identified for the hour the failure occurs shall be re-sampled to obtain a twenty-eight (**28**) specimen sample for edge bending tests as specified in Section 15.4.2.1.1.
- For the purposes of this example, it is assumed that the **28**-specimen re-sample had no 5th %ile edge-wise failures and therefore no further action is required.

Lines 25/26: **See 15.4.2.1.2 for appropriate action**:

When an edge and/or flat bending specimen test fails to meet the **"minimum bending strength"** value as provided in Tables 4 to 7 for SPS 1 or Tables 2 to 5 for SPS 3, as applicable, then the facility shall be deemed to be **"OUT-OF-CONTROL**" and subject to the following actions:

i) An examination of the bending test procedures shall be made to determine if there were errors in calibration procedures and/or calculations; and

ii) If no such errors are identified, the production from which the last quality control specimen was taken shall be re-sampled to obtain a twenty-eight (**28**) specimen sample for edge and/or flat bending tests as specified in Section 15.4.2.1.2. If the results from the bending tests fail to meet the requirements of Section 13.6.2.1.2, the production identified to be **"OUT-OF-CONTROL"** shall be rejected and the grade stamps shall be obliterated or removed.

- For the example provided, the specimen edge bending test failed below the "minimum" required bending strength value, therefore the FJ production identified as the product produced between 9:00 a.m. and 10:00 a.m. shall be re-sampled to obtain a twenty-eight (**28**) specimen sample for edge bending tests as specified in Section 15.4.2.1.2.

- If the **28**-specimen sample meets the **"5th %ile bending strength"** requirements of Section 13.6.2.1.2, the process is considered re-qualified**.** Once back **"IN-CONTROL",** the sampling frequency shall be increased (doubled, tripled, etc.) and maintained until an additional **25-**specimen sample has been generated and tested for the edge-wise orientation. "**All**" of the **25** additional test results shall meet or exceed the **"minimum bending strength"** value as provided in Tables 4 to 7 for SPS 1 or Tables 2 to 5 for SPS 3, as applicable, and not more than one (**1**) of the test results shall be below the "**5th %ile bending strength"** value.

- If these additional limits are not met, the process is again deemed to be **"OUT-OF-CONTROL"** for the minimum edge-wise bending strength.

- For the purposes of this example, it is assumed that the **25**-specimen re-sample had no edge-wise minimum bending strength failures and therefore no further action is required.

Line 30: **See 15.4.2.2a for appropriate action**:

If one or more quality control delamination test specimens from any half-shift of production is greater than 10%, a **5**-piece verification sample (as per Section 15.2.2.3d in SPS 1 or Section 15.2.2.2d in SPS 3) shall be randomly selected from the held production.

- For the example provided, a failure occurred to the delamination specimen sampled at 2:00 p.m. and therefore the FJ production must be held pending the delamination results from a **5**-piece verification sample. Five (**5**) specimens shall be randomly selected from the held production (production since the previous half-shift) and subjected to one (**1**) vacuum pressure drying cycle and the results of the tests shall determine the course of action to be taken:

a) If the average delamination of the **5**-piece verification sample exceeds 10%, the half-shift of held production from which the samples were drawn shall be deemed to be "**OUT-OF-CONTROL**" for delamination.

b) If the average delamination of the **5**-piece verification sample is equal to or less than 10%, the half shift of held production from which the samples were drawn, and the first half-shift of production if operating under Level II sampling, shall be deemed to be "**IN-CONTROL**" for delamination.

Line 42: **See 15.2.2.2 & Table 9 in SPS 1 or Table 7 in SPS 3 for appropriate action**:

The delamination results shall be assessed using Table 9 in SPS 1 or Table 7 in SPS 3 to determine if verification sampling in accordance with 15.2.2.3d in SPS 1 and Section 15.2.2.2d in SPS 3 is required.

- For the example provided, one delamination specimen in the half-shift tested greater than 5% but less than 10% delamination. Table 9 in SPS 1 or Table 7 in SPS 3 requires that only if all 4 samples in the half-shift are between 5 and 10%, then a verification sample is required.
- Therefore, this half-shift is deemed to be "**IN-CONTROL**".

Line 46: This is the same scenario as Line 30 above.

Lines 53 to 56: **See 15.4.2.2 & Table 9 in SPS 1 or Table 7 in SPS 3 for appropriate action**:

The delamination results shall be assessed using Table 9 in SPS 1 or Table 7 in SPS 3 to determine if verification sampling in accordance with 15.2.2.3d in SPS 1 and Section 15.2.2.2d in SPS 3 is required.

- For the example provided, all four (**4**) delamination specimens tested between 5 and 10% delamination. Table 9 in SPS 1 or Table 7 in SPS 3 requires that if all 4 specimens in the half-shift are between 5 and 10%, then a **5**-piece verification sample is required.
- In this case, for the production from the 1:00 p.m. to 4:00 p.m. timeframe, five (**5**) specimens shall be selected and subjected to one (**1**) vacuum pressure drying cycle and the results of these tests shall determine the course of action to be taken:

  a) If the average delamination of the **5**-piece verification sample exceeds 10%, the half-shift of held production from which the samples were drawn shall be deemed to be "**OUT-OF-CONTROL**" for delamination.

  b) If the average delamination of the **5**-piece verification sample is equal to or less than 10%, the half shift of held production from which the samples were drawn, and the first half-shift of production if operating under Level II sampling, shall be deemed to be "**IN-CONTROL**" for delamination.

Lines 65/66: **See 15.4.2.1.2 for appropriate action**:

When an edge and/or flat bending specimen test fails to meet the **"minimum bending strength"** value as provided in Tables 4 to 7 for SPS 1 or Tables 2 to 5 for SPS 3, as applicable, then the manufacturing facility shall be deemed to be **"OUT-OF-CONTROL**" and subject to the following actions:

i) An examination of the bending test procedures shall be made to determine whether there were errors in calibration procedures and/or calculations;

ii) If no such errors are identified, the production from which the last quality control specimen was taken shall be re-sampled to obtain a twenty-eight (**28**) specimen confirmation sample for flat bending tests as specified in Section 15.4.2.1.2. If the results from the bending tests fail to meet the requirements of Section 13.6.2.1.2, the production identified to be **"OUT-OF-CONTROL"** shall be rejected and the grade stamps shall be obliterated or removed.

- For the example provided, the flat bending test failed below the "minimum" required bending strength value, therefore the FJ production identified as the product produced between 1:00 a.m. and 2:00 a.m. shall be re-sampled to obtain a twenty-eight (**28**) specimen sample for flat bending tests as specified in Section 15.4.2.1.2.
- If the **28**-specimen re-qualification sample meets the **"5th %ile bending strength"** requirements of Section 13.6.2.1.2, the process is considered **"IN-CONTROL"**. Once back **"IN-CONTROL",** the sampling frequency shall be increased (doubled, tripled, etc.) and maintained until an additional **25-**specimen sample has been generated and tested for the flat bending orientation that was found to be **"OUT-OF-CONTROL"**. "**All**" of the **25** additional test results shall meet or exceed the **"minimum bending strength"** value as provided in Tables 4 to 7 for SPS 1 or Tables 2 to 5 for SPS 3, as applicable, and not more than one (**1**) of the test results shall be below the "**5th %ile bending strength"** value. Otherwise, the process is deemed to be **"OUT-OF-CONTROL"** for the minimum edge-wise bending strength.
- For the purposes of this example, it is assumed that the **25**-specimen re-sample had no flat-wise minimum bending strength failures and therefore no further action is required.

Lines 73 to 76: This line is the same scenario as Lines 53 to 56.

Line 78: This line is the same scenario as Line 42.

Line 79: This line is the same scenario as Line 30.

Lines 81 to 84: These lines are the same scenario as Lines 53 to 56.

Lines 86/87: These lines are the same scenarios as Line 42.

Line 88: This line is the same scenario as Line 30.

Lines 73 to 88: See 15.4.2.2d for appropriate action:

If **four or more** consecutive half-shifts of production are deemed to be "**OUT-OF-CONTROL**" for delamination, the **process** shall be deemed to be "**OUT-OF-CONTROL**" and shall be requalified for delamination as specified in Section 13.4.2.

Note: Re-qualification tests are limited to those items that are deemed to be "**OUT-OF-CONTROL**".

- For the example provided, failures occurred in four (**4**) consecutive half-shifts (from lines 73 – 88). If each of the four (**4**) half-shift **5**-piece delamination test results were deemed to be "**OUT-OF-CONTROL**" following verification testing, then the product process must be re-qualified for delamination (Section 13.4.2) as follows:

  a) Randomly selecting twenty (**20**) fingerjoint specimens from on-going production and testing them in accordance with Section 9.2; and

  b) The results of the test must satisfy Section 13.6.1.2.