LF–01

SPECIFICATIONS AND TEST METHODS

NALFA Surface Swell Test – Assembled Joint

NORTH AMERICAN LAMINATE FLOORING ASSOCIATION

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Purpose: To evaluate surface swell of finished Laminate flooring product when exposed to water, utilizing an assembled joint**.**

A. Materials needed:

1. Two planks with undamaged profiled edges. **Test is to be run in duplicate**. Each test requires one plank

2. Plastic ring (PVC Pipe) – 4” (100 mm) inner diameter, at least 1” (25.4 mm) tall

3. Beaker capable of measuring 100ml of water, approx. 3/8” (9 mm) deep

4. Distilled or de-ionized water, room temperature; 23 Deg C +/- 3 Deg C (73 Deg F +/- 5 Deg F)

5. Red dye food color

6. Vaseline, silicone caulk or plumbers putty to seal the ring to the laminate plank.

7. Example measuring device shall consist of a two or three footed flat support frame with dial indicator comparator that can measure changes in surface height at a specified location. See Figure 1. The unit shall be equipped with a micrometer gauge capable of measuring up to nominal 25 mm (1 inch) graduated to 0.02 mm (0.001 inches). The foot/anvil of the indicator shall have a diameter of 10 mm +/- 1 mm (0.394 inches +/- 0.039 inches) with an exerted force of 100 g + 14 g (3.5 oz + 0.5 oz). Other suitable devices may be utilized, provided they offer at least equivalent measurement capability. It is recommended to use the same calibrated measurement gauge for before and after testing measurements.

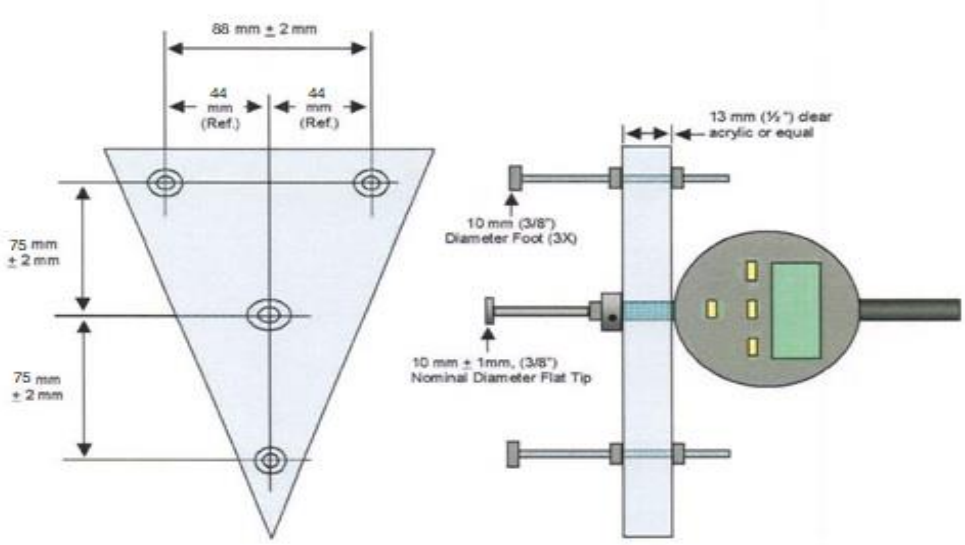


Figure 1
Measurement Device

B. Conditioning:

1. Prior to testing for surface swell properties, specimens are to be conditioned per manufacturer's pre-installation acclimation recommendations and if acclimation conditions are not specified then acclimate specimens at 23 Deg C +/- 3 deg C (73 Deg F +/- 5 deg F) and 50 % RH +/- 5% RH, for 24 hours

C. Procedure:

1. **Inspect each test plank and ensure they are free of damage on all 4 sides.**
2. Cut a minimum of 6" (152.4 mm) off of both ends (Part A and C) of the laminate plank and use a minimum 12" (304.8 mm) from the center (Part B). See Figure 2.

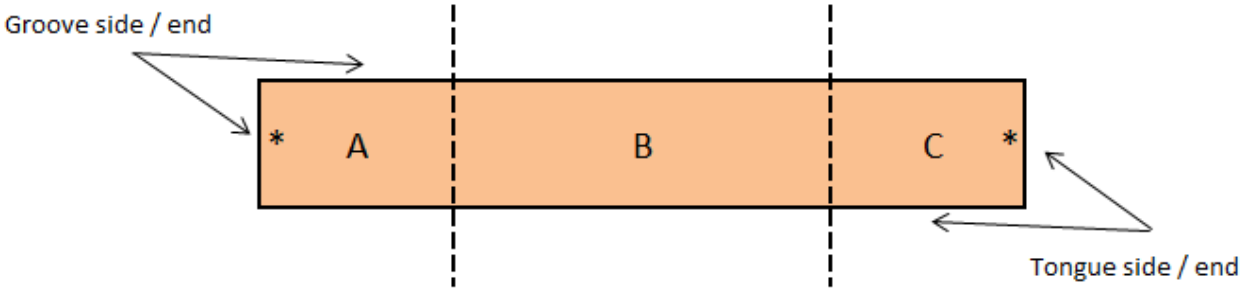


Figure 2 - Plank Layout

"*" Reference for assembling planks

3) Prior to assembly, make sure to thoroughly clean profiled edges of each specimen part (A, B & C). Preference is to use an air gun and blow the profiled edges clean, followed by cleaning with a small brush, suited to the task.
4) Assemble parts A and C according to manufacturer recommended installation instructions, making sure the tongue and groove sections are properly engaged. Join part B (Groove side) to the assembled parts “C & A” (Tongue side) according to manufacturer recommended installation instructions, to create the inverted “T” joint. – See Figure 3 Note: review assembly to ensure no visible gaps between the elements. Assembling, testing, viewing and rating should be in a well lighted area with specimens placed on a sturdy, flat bench or table, with good viewing access at typical counter top or table top height.
5) When assembling test specimen, if any gaps are noticed, the test specimen should be disassembled, according to manufacturer recommended disassembly instructions, recleaned then reassembled, according to manufacturer recommended installation instructions, prior to testing.

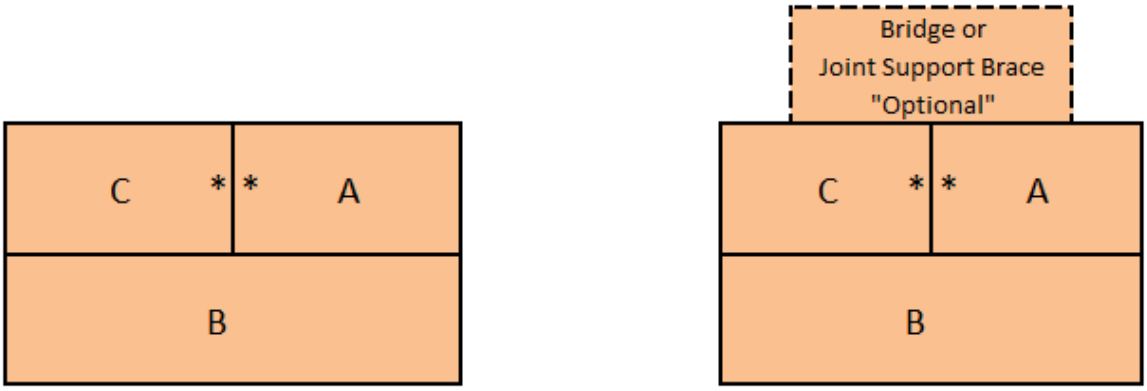
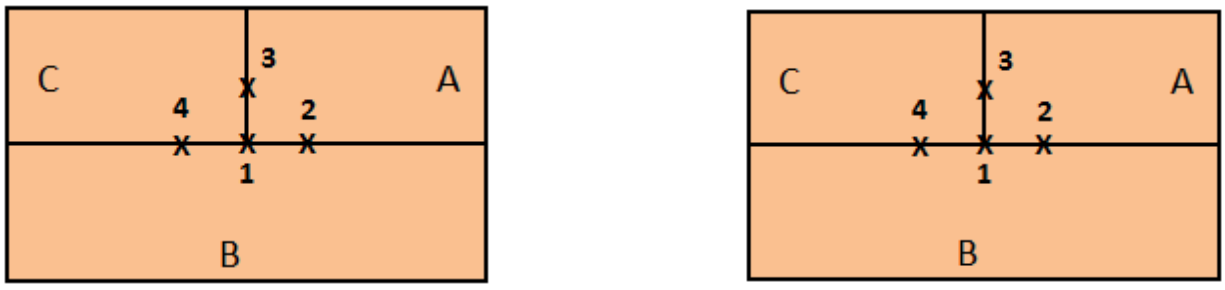


Figure 3 – Assembled Plank Layout

Note here: A bridge or joint support brace may be used to ensure Parts C & A are properly engaged and remain flat during the test.

6) Mark test locations at 1 ½”(38.1 mm) on three sides of the center length mark - See Figure 4.



Specimen 1 Specimen 2

Figure 4 – Test Locations on Assembled Planks Two side by side specimens, 1 and 2

Test Location 1 – Intersect point of inverted “T” Joint
Test Location 2 – 1 ½” (38.1 mm) from Test Location 1 to right
Test Location 3 – 1 ½” (38.1 mm) above Test Location 1
Test Location 4 – 1 ½” (38.1 mm) from Test Location 1 to left

7) Apply a bead of sealant (i.e. petroleum jelly, silicone caulk or plumbers putty) to one edge of the 4” (100 mm) diameter ring using a syringe or other suitable method. The bead must be continuous and approximately 3mm in thickness (nom. 1/8”) – See Figure 5.

Figure 5 – Example application of Sealant to Bottom of Plastic Ring

8) Place the 4” (100 mm) ring over the inverted “T” joint as shown in Figure 6 with the sealant side down. Press down firmly and wiggle the ring slightly (without shifting its position) to help seal it to the surface of the Laminate planks. On both inside and outside of the ring, **make sure to take extra care when sealing the ring to the laminate surface, especially at the joint location points. Make sure assembled pieces are flat and joints fully engaged**.

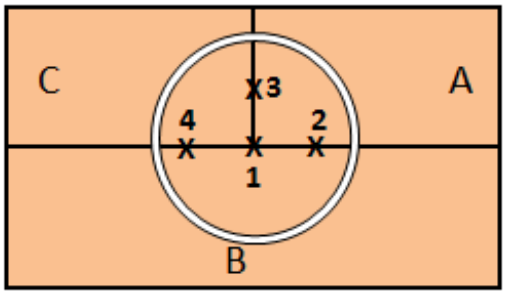


Figure 6 Assembled Laminate Planks with Plastic Ring seal

9) Zero measuring device on granite block or equivalent flat surface.

10) Measure height, in mm, at each test location and record data in worksheet.

Note: Make sure the measurement device feet do not sit on any joint. When taking each test location initial measurement, mark the foot locations of the measuring device so that it can be positioned back in the exact same location when taking the follow up measurements for wet swell and recovery height readings (optional). For any subsequent measurements make sure measurement device feet are in the exact marked locations. Make sure the measurement device feet fall outside of the plastic ring location and sit flat and level on the surface~~,~~ when measuring joint height of test locations – See Figure 7.

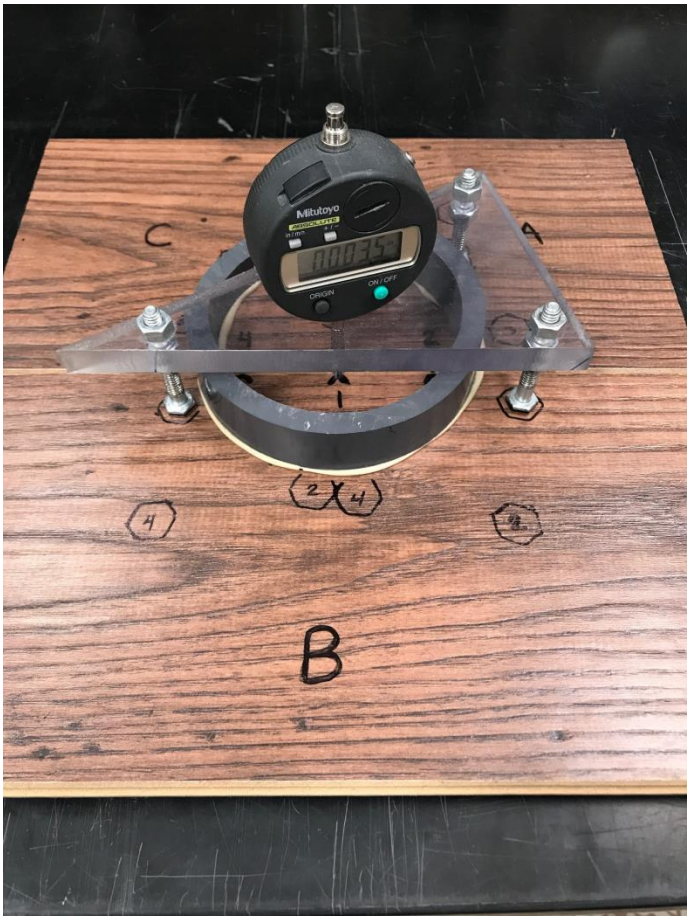


Figure 7 – Example of marked foot locations of measurement device

11) Using a clean beaker add 100 ml of **room-temperature distilled or de-ionized water plus 5 drops of red food color. Stir or swirl beaker until color is uniformly dispersed. Pour the water into the ring sealed to the laminate floor surface**. Water level should be approximately 3/8” (9 mm) deep – See Figure 8

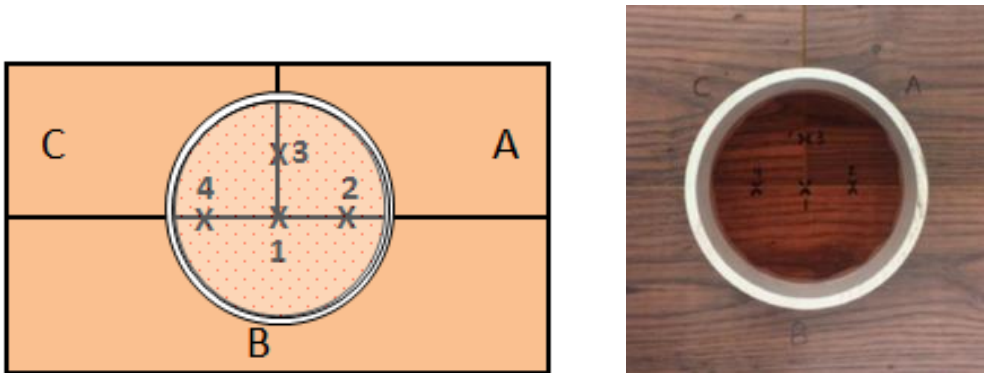


Figure 8 – Assembled Plank Surface Water Exposure Test Set Up

Note - For the first 5-10 minutes after filling, watch the test assembly closely to make sure no leaks develop around the outer edge of the ring. If a leak is found, apply additional Vaseline or plumbers putty to the base of the ring along the outer perimeter – See Figure 9.

12) Allow the test assembly to stand for 24 hours. **Within 15 minutes after the 24 hour mark**, remove the water (Pipet out or use a clean sponge and discard water) and complete qualitative rating (See Section 11) and quantitative rating (See Section 12). Pat dry using paper towel. **Leave the test assembly intact throughout the water removal process and evaluation process**.

13) **Qualitative rating procedure for Wet swell evaluation – See Section D, Paragraph 1. Complete within 15 minutes after 24 hour exposure**

14) **Quantitative rating procedure for Wet swell - See Section E, Paragraph 2. Complete within 15 minutes after 24 hour exposure**

15) **Qualitative rating procedure for Recovery swell evaluation – See Section D, Paragraph 1. Complete within 15 minutes after 48 hour exposure**

16) **Quantitative rating procedure for Recovery swell – See Section E, Paragraph 3. Complete within 15 minutes after 48 hour exposure**

D. Rating

1) For **Qualitative rating** - Evaluate the joints for apparent differences, in **visual** swell and feel (light touch can be helpful in discerning differences) within the circle compared to unexposed portions of the specimen and grade the test assembly per the criteria listed below:

Grade:

1 = No change - No noticeable change in edge swell or panel surface lift
2 = Slight swelling – Slight swelling, small ridge along one or more joints, very little if any panel surface lift.
3 = Moderate – Noticeable edge swelling and some panel surface lift extending away from joint
4 = Objectional – Severely raised edge and swelling extending noticeably under the panel surface.
5 = Invalid Test – Water leaked out of the ring, leaving no continuous film of water inside the ring (this grade is given even if there is no swell of the edge joint)

See Annex for example pictures – Qualitative rating

Figure 9 – Example of Joint Failure – Water Through Leakage

Make a notation if all (no longer a continuous film of water in the ring) the water ran out of the plastic ring. The type of leak that would cause a score of “5” (failure) is one where the water has entered the joint and ran through and or out along the joint onto the surface upon which the test specimen(s) is sitting.

Even though some water may leak out, provided there is a continuous layer of water remaining in the plastic ring on the laminate surface, the test is considered valid.

A) If the sample fails (a score of 3 or higher), repeat the test using a plank from the same box or production time frame.

   a. If the repeat sample passes, the overall test should be considered a pass.
   b. If the repeat sample fails, the overall test should be considered a fail.

B) For determining **Quantitative Wet Swell values**, measure the height at the Position 1 – Position 4 locations for swell after the 24 hour standing surface water exposure period following steps 7 & 8. Record values in the worksheet and refer to Section E – Calculations to determine Wet Swell Values

C) For determining, Qualitative rating and **Quantitative Recovery Swell values,** within 15 minutes after the 24 hour Recovery time period, follow Section D for determining Qualitative rating; follow steps 7 & 8 for quantitative measurements. Record values in the worksheet and refer to Section E – Calculations to determine Recovery Swell Values.

E. Calculation

Surface Swell Calculation

Position 1 (inverted "T") wet swell = Position 1 wet height – Position 1 initial height
Position 2 wet swell = Position 2 wet height – Position 2 initial height
Position 3 wet swell = Position 3 wet height – Position 3 initial height
Position 4 wet swell = Position 4 wet height – Position 4 initial height

1. Express the "Wet $swell_{sample\ average}$" as the average of the Position 2 – 4 wet swell values in mm units. Position 1 readings, the inverted "T" $Joint_{wet\ swell\ value}$ shall be recorded separately, also reported in mm units.

2. The "Wet $swell_{final\ average}$" value is the average of the two test sets of measurements, when both test specimens give valid data. If one "failed test" (due to excess leakage), report data along with notation that reported values represent a single set of data. If both specimens fail due to excess leakage, no wet swell values are reported and test is reported as a "failure"

3. It is suggested to also do Recovery seam swell measurements taken 24 hours after the wet swell measurements were determined to see if there is recovery (less swelling after drying) of the swelled joint

Recovery Calculation

Position 1(inverted "T") Recovery swell = Position 1 Recovery height – Position 1 initial height
Position 2 Recovery swell = Position 2 Recovery height – Position 2 initial height
Position 3 Recovery swell = Position 3 Recovery height – Position 3 initial height
Position 4 Recovery swell = Position 4 Recovery height – Position 4 initial height

4. Express the "Recovery $swell_{sample\ average}$" as the average of the Position 2 – 4 $Recovery_{swell\ values}$ in mm units. Position 1 readings, the inverted "T" $Joint_{Recovery\ swell\ value}$ shall be recorded separately, also reported in mm units.

5. The "Recovery $swell_{final\ average}$" value is the average of the two test sets of measurements, when both test specimens gives valid data. If one "failed test"(due to excess leakage), report data along with notation that reported values represent a single set of data. If both specimens fail due to excess leakage, no Recovery swell values are reported

F. Statistics

Precision & Bias

Table 1 is based on interlaboratory studies conducted in 2018 involving four materials, using three replicate tests and six laboratories. Statistics for recovered surface swell test for Points 2-4; values in mm.

Material	Mean	S_r	S_R	I_r	I_R
A	0.27	0.05	0.10	0.14	0.27
B	0.06	0.04	0.23	0.13	0.66
C	0.22	0.09	0.09	0.24	0.25
D	0.14	0.05	0.16	0.14	0.45

Table 1

In Table 1, for the materials indicated:
Mean is the average of test results for all replicates from all labs.
S_r is the within-laboratory standard deviation of the mean and $I_r = 2.83S_r$
S_R is the between-laboratory standard deviation of the mean and $I_R = 2.83S_R$
Repeatability - In comparing two mean values for the same material obtained by the same operator using the same equipment on the same day, the means should be judged not equivalent if they differ by more than the I_r value for that material and condition.
Reproducibility - In comparing two mean values for the same material obtained by different operators using different equipment on different days, the means should be judged not equivalent if they differ by more than the I_R value for that material and condition. (This applies between different laboratories or between different equipment within the same laboratory.) The judgments based on the Repeatability and Reproducibility will have an approximate 95% (0.95) probability of being correct. Other materials may give somewhat different results.

G. Report

Laminate Surface Swell Test- Assembled Joint

Product ID _____ Date _____

Appendix A
Seam Swell - Table of Individual Results

Specimen # 1 Specimen # 2

Test Loc. 1 (inverted "T" joint) Initial measurement
Test Loc. 2 Initial measurement
Test Loc. 3 Initial measurement
Test Loc. 4 Initial measurement

Test Loc. 1 (inverted "T" joint) Wet swell measurement
Test Loc. 2 Wet swell measurement
Test Loc. 3 Wet swell measurement
Test Loc. 4 Wet swell measurement

Test Loc. 1 (inverted "T" joint) Redry measurement
Test Loc. 2 Recovery measurement
Test Loc. 3 Recovery measurement
Test Loc. 4 Recovery measurement
Refer to Calculation Section D for determining summary reported values

Test Position 1 (inverted "T" joint) **Initial** measurement	
Test Position 2 **Initial** measurement	
Test Position 3 **Initial** measurement	
Test Position 4 **Initial** measurement	
Test Position 1 (inverted "T" joint) **Wet** swell measurement	
Test Position 2 **Wet** swell measurement	
Test Position 3 **Wet** swell measurement	
Test Position 4 **Wet** swell measurement	
Test Position 1 (inverted "T" joint) **Recovery** swell measurement	
Test Position 2 **Recovery** swell measurement	
Test Position 3 **Recovery** swell measurement	
Test Position 4 **Recovery** swell measurement	

Addendum

1) Post-test analysis - Follow quantitative rating procedures for Recovery (optional step).
2) After all measurements are complete, and samples disassembled, observe and report the location of the dye solution in the joint relative to the ring location (optional step).
3) Work Sheet is provided for purposes of easier data recording

Appendix B
Example photos to match with subjective ratings

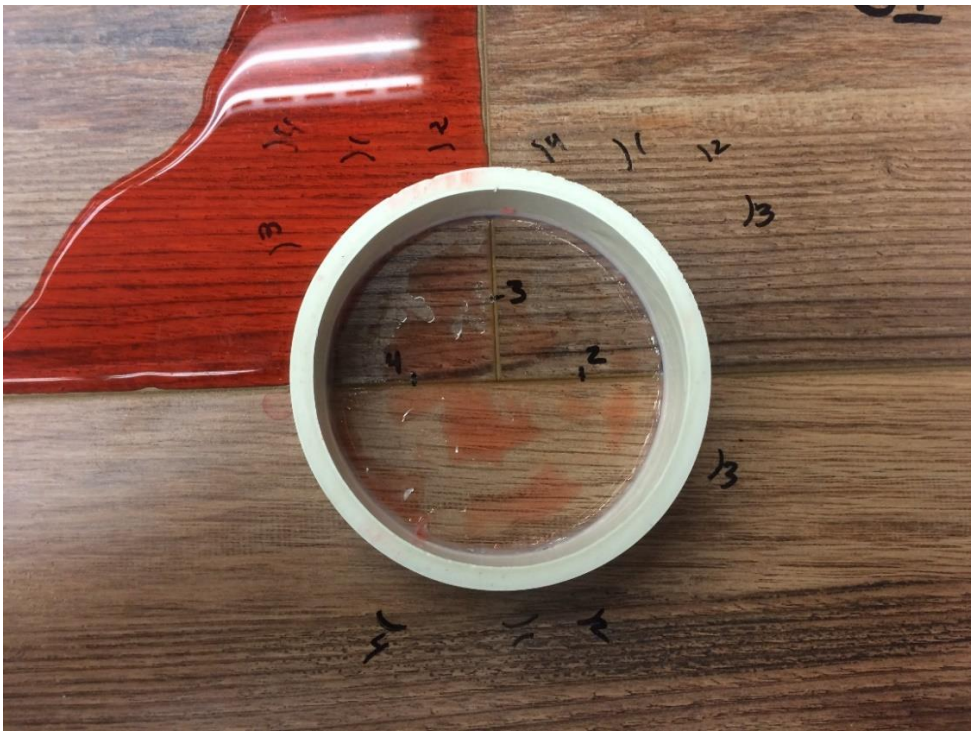
1 – Little to no noticeable change in edge swell or panel surface lift

2 – Slight swelling, small ridge along one or more joints, very little, if any panel surface lift.

3 – Moderate or noticeable edge swelling and some panel surface lift extending away from joint

4 – Objectional – Severely raised edge and swelling extending noticeably under the panel surface.

5. Invalid Test – Water leaked out of the ring, leaving no continuous film of water inside the ring(this grade is given even if there is no swell of the edge joint)



Special note: See below, even though some water may leak out, provided there is a continuous layer of water remaining in the plastic ring on the laminate surface after the 24 hr exposure time, the test is considered valid.