

Laminate Flooring Installation Guidelines and Methods





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Notice

The North American Laminate Flooring Association assumes no responsibility and accepts no liability for the principles or techniques contained in these guidelines/methods.

These guidelines/ methods for the installation of laminate flooring were developed by the NALFA Technical Committee, using reliable installation principles, with research of all available flooring installation data and in consultation with leading industry authorities. The methods are not intended to apply to unrelated floor issues absent in a causal connection.

While every effort has been made to produce accurate and generally accepted guidelines, the principles and practices described in this publication are not universal requirements. The recommendations in this publication are directed at the North American market in general, and therefore may not necessarily reflect the most accepted industry practices in your geographic area. Some installation methods and materials may not be suitable in some geographic areas because of local trade practices, climatic conditions or construction methods. All laminate flooring installations must conform to local building codes, ordinances, trade practices and climatic conditions.

In addition, manufacturers' recommendations for installation of specific products should always supersede the recommendations contained in this publication.

It is recommended that all laminate flooring products be installed in accordance with the NALFA Installation Guidelines and all applicable manufacturer guidelines by a Certified Installer, NALFA Member, or equivalent.

Acknowledgement

The North American Laminate Flooring Association would like to gratefully acknowledge the great assistance provided by the National Wood Flooring Association, who shared information from industry leaders.

NALFA Involved Parties

General Definitions

Manufacturer: Any individual or entity that physically manufactures, sells or markets laminate flooring product.

Specifier: Any individual or entity (including, but not limited to, architects, builders, consultants, design centers, designers/decorators, end users, general contractors, flooring contractors, sales professionals) that recommends, specifies, or in any way advises the buyer prior to ordering, purchasing, and/or installing the laminate floor products.

Supplier: Any individual or entity (including, but not limited to, distributor, importer) that receives product from a manufacturer and supplies the laminate flooring products to a seller or buyer.

Seller: Any individual or entity (including, but not limited to, retail stores, big box stores, internet sales, interior designers, direct sales) that physically supplies/sells the laminate flooring products to the buyer.

Buyer: Any individual or entity (including, but not limited to distributors, homeowners, installers, flooring contractors, general contractors) that is the first to use/handle/possess/receive/deliver the laminate flooring material prior to installation of the laminate flooring product.

Installer: Any individual or entity that physically installs and places into service the laminate flooring product.

End-User: Any individual or entity that physically receives and puts to use the final laminate flooring product.

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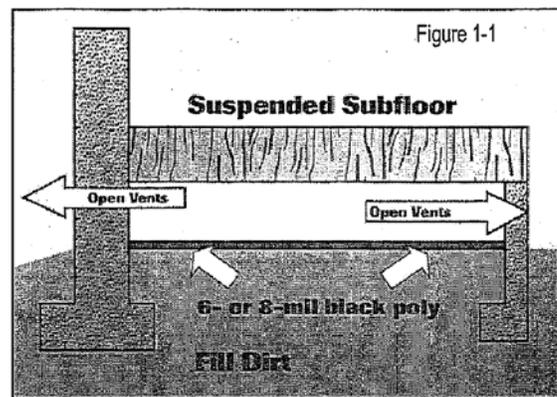
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Jobsite Conditions

Laminate flooring by design is not to be used to strengthen/stiffen a subfloor and will not do so. If movement of the subfloor occurs prior to installation and is not corrected, that same movement will occur after installation is complete.

Minimum Jobsite Requirements

- A. Laminate flooring should be one of the last jobs completed on the construction project. Limit foot traffic on finished flooring.
- B. Evaluate the jobsite for potential problems before installation begins, and before laminate flooring is delivered to the jobsite.
- C. Installation constitutes acceptance of flooring material, subfloor/substrate, the jobsite itself including the ambient temperature and relative humidity at the time of installation, and all impacting variables that may affect a laminate floor. For warranty and/or hold harmless agreements, check with legal counsel.
 1. Exterior surface drainage should direct water away from the building.
 2. Do not deliver laminate flooring to the jobsite or install laminate flooring until the building is enclosed.
 3. If heating and/or air conditioning is in operating condition, it needs to be operating. If it is not possible for the permanent heating and/or air conditioning system to be operating before, during and after installation, a temporary heating and/or dehumidification system that mimics normal temperature and humidity conditions can enable the installation to proceed until the permanent heating and/or air conditioning system is operating.
 4. Do not deliver laminate flooring to the jobsite or install laminate flooring until appropriate temperature and humidity conditions have been achieved. Appropriate temperature and humidity conditions are defined as those conditions to be experienced in the building after occupancy.
 5. Do not deliver laminate flooring to the jobsite or install laminate flooring until all concrete, masonry, plastering, drywall, texturing and painting primer coats are completed.
 6. Basements and crawl spaces must be dry. If power washing is required in the basement, do so before laminate flooring is installed and allow subfloor and basement to dry before installing laminate flooring.
 7. Crawl space should be a minimum of 18" (457mm) from ground to underside of joists.
 8. Crawl space earth (or thin concrete slab) should be covered 100 percent by a vapor retarder of black polyethylene (minimum 6 mil) or any recommended puncture-resistant membrane, such as Class C, meeting ASTM D1745. See Figure 1-1. Check local codes.
 9. Crawl Space Conditions
 - a. Where a proper ground covering is in place and when venting is required by local building codes, the crawl space should have perimeter venting equal to a minimum of 1.5 square feet per 100 square feet of crawl space square footage, unless local building codes differ from this specification. Note: Local building codes may differ. Follow local building codes.
 - b. For crawl spaces without ventilation openings, vapor retarder joints must overlap a minimum of 6 inches and be sealed or taped. The vapor retarder should also extend at least 6 inches up the stem wall and be attached and sealed to the stem wall. Continuously operated mechanical exhaust and



perimeter wall insulation or conditioned air supply and insulation must be provided.

10. Laminate Flooring can be installed on any grade of a residence or building. For installation above concrete on or below grade situation, be sure to use a recommended vapor barrier like a polyethylene film of at least 6 mils unless already pre-attached to the flooring element.
11. Subfloors (wood or concrete) should be checked by an appropriate method for establishing moisture content. Average subfloor moisture content should be within the range as specified for the product by the product manufacturer. See Chapter 3, Moisture Testing. See Figure 1-2.
12. Where the minimum jobsite conditions are present, the flooring can be delivered and stored in the rooms in which it will be installed. Follow manufacturer's recommendations for acclimation.

Wood sub floors:

- A. Wooden sub floors must be constructed per local building codes, be structurally sound and deflection free.
- B. Repair any squeaky floor prior to installation.
- C. Sand or plane high spots.
- D. Fill all low spots with Portland cement based patching compound.
- E. Floor patch applied per the manufacturer's recommendations is a good choice to fill low spots. It is not necessary to use a vapor retarder on top of a wooden sub floor.

Additional Jobsite Conditions

- A. All finished wall coverings and painting should be completed. Note: Base and shoe mold may be installed after the flooring installation.
- B. After installation, if you choose to protectively cover the floor.

As in all installations, at completion of job, inspect flooring from a standing position.

Jobsite Checklist

See Appendix M.

Remodel Installations

Be aware of the most current EPA regulations for lead paint dust, formaldehyde as well as asbestos (www.epa.gov).

Acclimation and Conditioning of Laminate Flooring

Always follow the manufacturer's recommendations regarding how and whether to acclimate laminate flooring.

General Acclimation/Conditioning

Definitions:

Acclimation: The process of adjusting (conditioning) the moisture content of laminate flooring to the environment in which it is expected to perform.

Equilibrium Moisture Content: The moisture content of laminate when in equilibrium with its environment. When laminate is neither gaining, nor losing moisture, equilibrium moisture content (EMC) has been reached.

A. Storage and Conditions

1. Do not store laminate flooring at the jobsite under uncontrolled environmental conditions. Garages, and exterior patios, for example, are not acceptable areas to store laminate flooring.
2. Ideal interior environmental conditions vary from region to region and jobsite to jobsite. It is the flooring professional's responsibility to know what the "ideal" climate conditions are and customize the floor around those conditions.
 - a. Determine what the expected seasonal change of moisture content is for your geographical location. For a general view of moisture-content averages by region, See Appendix D and Appendix E.
 - b. It is not normally necessary to check moisture content of laminate flooring.
 - c. Under normal condition, it is not necessary to have laminate flooring to acclimate to the room environment. Always follow specific manufacturer's requirement for acclimation.

B. General

Note: Most manufacturers do not require acclimation for their products prior to installation. If the manufacturer recommends that the laminate flooring be acclimated before installation, proceed as follows:

1. Ensure that the building is enclosed.
2. Verify that the building is maintained at normal living conditions for temperature and humidity.
3. Where building codes allow, permanent heating and/or air conditioning systems should be operating at least five days preceding installation to promote proper acclimation and should be maintained during and after installation. For radiant heat, see Appendix H.
4. If it is not possible for the permanent heating and/or air conditioning system to be operating before, during and after installation, a temporary heating and/or dehumidification system that mimics normal living (occupied) conditions can enable the installation to proceed until the permanent heating and/or air conditioning system is fully operational.
5. Acclimate the laminate flooring as necessary (see Chapter 2, Part II, Acclimation).

Note: Not properly acclimating laminate flooring may cause excessive expansion, shrinkage, dimensional distortion or structural damage. The worst-case scenario is one in which laminate flooring is stored at the jobsite in an uncontrolled environment, then immediately installed. This is especially true when the materials are stored in an area that is subject to excessive moisture and humidity conditions. Acclimation outside of the area in which the laminate is to be installed does no good at all; in fact, it is likely harmful to store laminate flooring at the jobsite under conditions that don't reflect expected normal environmental conditions.

Acclimation

Laminate flooring is a hygroscopic material subject to dimensional change because of variations in moisture, temperature and humidity within the surrounding environment. Laminate flooring is generally close enough from moisture content level in equilibrium with the normal surrounding environment (EMC) in which it will be installed,

at or near normal living conditions. The process of reaching this equilibrium is defined as acclimation, would allow the laminate flooring to properly adjust itself to the normal living conditions within the structure; that is, the temperature, humidity conditions and moisture content that will typically be experienced once the structure is occupied.

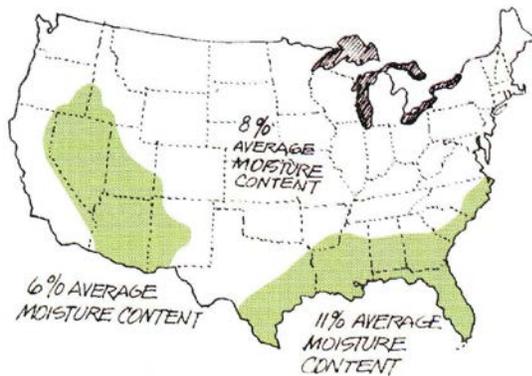
A. The Process of Acclimation

If the manufacturer recommends that the laminate flooring be acclimated before installation, proceed as follows:

1. Some manufacturers will recommend acclimation for up to 48 hours prior to installation.
2. If recommended by the manufacturer, stack the material flat in unopened boxes for the time recommended.

B. Laminate flooring Comfort Zone

1. As a rule, with geographic exceptions, laminate flooring will perform best when the interior environment is controlled to stay within a relative humidity range of 30 to 50 percent and a temperature range of 60° to 80° Fahrenheit. (In some climates, the ideal humidity range might be higher or lower, 25 to 45 percent or 45 to 65 percent, for example.)
2. The chart below indicates the moisture content laminate will likely have at any given combination of temperature and humidity. Note the equilibrium moisture content in the recommended temperature/humidity range (shaded area) coincides with the 6-to-9 percent range used by most flooring manufacturers during the manufacturing/shipping process. Although some movement can be expected between 6 and 9 percent, laminate flooring can shrink or swell more dramatically outside this range. When laminate is neither gaining, nor losing moisture, equilibrium moisture content (EMC) has been reached.



Moisture Content in Wood at Equilibrium

Moisture Guideline Testing and Vapor Retarders

Reference to ASTM Standard revisions: ASTM Standards listed are most recent revisions or use ASTM Standard in effect at time of installation.

Moisture Testing for Laminate Flooring and Wood Subfloors

Determining moisture content is an essential part of quality control within the flooring installation process. Flooring Installers must know the moisture content of the laminate flooring, as well as the subfloor.

- A. The most accurate measurement for moisture content in laminate is the oven-bake-out method. However, it is not widely used because the cost and difficulty of performing the test on-site is not practical.
- B. Hand-held electrical tools, called moisture meters, should be part of the toolbox of every flooring contractor for measuring moisture in subfloors and floors. Moisture meters have many purposes. They can be used to determine if floor boards are dry enough for an installation to proceed, they can check subfloors and concrete for high moisture levels, they can determine when a second coat of finish can be applied and they can assess water damage.

There are two main types of meters for testing laminate: probe and pinless.

- 1. The probe type measures electrical resistance across opposed sets of pins, which are pushed into the laminate. All probes should be inserted as instructed by the meter manufacturer. An advantage of probe type meters is that those with insulated pins can measure moisture content at varying depths; for example, you can determine whether the moisture content near the bottom of the board is higher than near the top.
- 2. The pinless, dielectric type employs signal penetration at one inch or more for laminate. The meter can be moved across the surface to identify pockets of moisture. It is relatively unaffected by temperature. Rough surfaces have very little effect on the reading. Newer pinless meters can be adjusted to depth desired. Older models may read deeper into flooring systems and not give an accurate reading of laminate flooring only.
- 3. Follow the meter manufacturer's recommendations to get an accurate reading from the laminate floor. One effective testing method is to remove a sample board and get a reading with air space beneath it.
- 4. It is important that the meter you chose offers the following:
 - a. A wide moisture content range from at least 6 percent to 30 percent.
 - b. The necessary adjustment tables, conversion charts or settings for various species.

Test for moisture at several locations in the room – a minimum of 20 per 1,000 square feet – and average the results. Document all results. A high reading in one area indicates a problem that must be corrected. Pay special attention to exterior and plumbing walls.

Moisture Testing for Concrete Slabs

Note: All tests give a result – at the time the test is done – and in general give you the ability to start or not start a job. These tests do not give a permanent condition of your substrate, but merely a “at the time the test was performed” indication.

- A. Testing Requirements
 - Before moisture testing begins, the concrete slab must be a minimum of 60 days old.
- B. Qualitative Moisture Tests – Electrical Impedance Test and Electrical Resistance Test (Moisture Meter)
 - Follow meter manufacturer's instructions.
 - 1. Use moisture meters designed specifically for concrete moisture testing.
 - 2. Test within the body of the slab (electrical resistance), as well as at the surface (electrical impedance).

3. These testing methods are not recognized by any standard and should not be used for accepting or rejecting a floor. These electronic tests are useful survey tools to broadly evaluate the relative moisture conditions of a slab and to select locations for quantitative moisture tests.
4. If the moisture meters indicate the presence of excessive moisture, as per laminate flooring or meter manufacturer's recommendations, further testing is required using relative-humidity testing (ASTM F2170), calcium chloride testing (ASTM F1869) or calcium carbide (CM) testing (ASTM D4944 and MilSpec CRD-C154-77).

C. Quantitative Moisture Tests

1. ASTM F1869 – Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.
 - a. This test method covers the quantitative determination of the rate of moisture vapor emitted from below-grade, on-grade, and above-grade (suspended) bare concrete floors.
2. ASTM F2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using In Situ Probes.
 - a. This test method covers the quantitative determination of percent relative humidity in concrete slabs for field or laboratory tests.
3. ASTM F2659 – Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter.
 - a. This guide focuses on obtaining the comparative moisture condition within the upper 1" (25.4 mm) stratum in concrete, gypsum, anhydrite floor slabs and screeds for field tests. Due to the wide variation of material mixtures and additives used in floor slabs and screeds, this methodology may not be appropriate for all applications. See 1.2 through 1.8 and Section 11 of ASTM F2659. Where appropriate, or when specified, use further testing as outlined in Test Methods F1869, F2170 or F2420 before installing a resilient floor covering.
4. Relative Humidity Testing – ASTM F2170 (Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using In Situ Probes).
 - a. Select test locations to provide information about moisture distribution across the entire concrete floor slab. For slabs on grade and below grade, include a test location within three feet of each exterior wall.
 - b. Perform three tests for the first 1,000 square feet and one test for every additional 1,000 square feet thereafter.
 - c. At least 48 hours before test is placed, concrete floor slabs should be at the same temperature and humidity that is expected during service conditions.
 - d. Use a rotary hammer-drill to drill holes in the concrete slab; 40% depth of slab is required for the holes when concrete is drying from one side and 20% when drying from both sides. Follow manufacturer's instructions provided with test kits.
 - e. Allow 72 hours to achieve moisture equilibrium within the hole before making relative humidity measurements. Follow manufacturer's instructions provided with test kits.
 - f. ASTM F710 provides installation guidelines for acceptance of laminate flooring using relative humidity testing. Typical limits for wood and wood-based products are 75% relative humidity. When getting readings over 75%, you must use a proper vapor retarder, based on the flooring manufacturer's recommendations, or wait for further concrete curing.
5. Calcium Chloride Test – ASTM F1869 (Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride).
 - a. Select test locations to provide information about moisture distribution across the entire concrete floor slab.
 - b. Perform three tests per 1,000 square feet of surface area. Add one additional test for each 1,000 square feet thereafter.
 - c. At least 48 hours before test is placed, concrete floor slabs should be at the same temperature and humidity expected during service conditions.
 - d. The actual test area shall be clean and free of all foreign substances. Use approved OSHA work practices for removal of all existing flooring materials and debris.

- e. Blast or grind a minimum area of 20 inches by 20 inches and let stand for a minimum period of 24 hours prior to setting test.
- f. Follow manufacturer's instructions for properly placing tests onto concrete.
- g. Tests are to be covered and left in place for 60 to 72 hours. Follow manufacturer's instructions for labeling and recording time and date of test.
- h. Send the test to a certified laboratory for results and documentation, or perform the measurements as per ASTM F1869.
- i. Always follow the flooring manufacturer's guidelines and specifications to determine when the concrete slab is ready for installation.
- j. ASTM F710 provides installation guidelines for acceptance of laminate flooring using calcium chloride testing. Typical limit for installing laminate flooring is 3lbs/1000sf/24hr. When getting readings over 3lbs and up to 7lbs, you must use a vapor retarder. A reading over 7lbs may not be acceptable for laminate flooring installation.

Note: For more information on the above instructions, contact your Flooring Specialist, the manufacturer of the product or NALFA at NALFA.com.

Vapor Retarders on Wood Subfloor

Over a wood subfloor, do not use an impermeable vapor retarder material, such as 6 mil polyethylene film or other polymer materials, as it may trap moisture on or in the wood subfloor. Such impermeable material may be used if recommended by the laminate flooring manufacturer as such materials have been measured for vapor transmission due to fastener penetration or include special backing to dissipate vapor horizontally.

Acceptable Vapor Retarders Over Concrete

- A. Always follow local codes and manufacturer's instructions.
- B. NALFA recommends to ALWAYS use an acceptable vapor barrier over concrete.
- C. Some acceptable vapor barriers/retarders over concrete include:
 1. A minimum 6 mil construction grade polyethylene film or other impermeable similar material.
 2. Recommended impermeable underlayment recommended by the laminate flooring manufacturer
 3. NALFA certified underlayment providing moisture protection and having a vapor transmission factor of less than 3 lbs./1000 sq. ft./24 hours

Installation Guidelines & Methods

Introduction

Laminate flooring is designed to be a floating floor that may be installed over virtually any type of subfloor. It is not nailed or glued to the sub floor. Instead, a glueless system with an extremely strong and durable tongue and groove "locking" system creates a beautiful, stylish floor to be enjoyed as soon as the installation is complete.

Just as all materials in the home expand and contract, laminate floors react to the changes in temperature and humidity. To allow the planks to adjust to the environment where they will live, acclimation is necessary and important. To acclimate, place unopened cartons of planks flat on the floor in the room where they will be installed at least 3 feet away from outside walls and heating/air conditioning vents for a 48-hour minimum prior to installation. Maintaining temperatures between 60 – 85 degrees Fahrenheit and a 35% - 65% relative humidity level provides a comfortable, healthy environment for people as well as the new flooring.

Because: this is a "floating floor", an expansion space must be left around the entire perimeter of the room and any fixed objects to allow for movement. Most manufacturers recommend an expansion space from 5/16" up to 3/8". FAILURE TO MEET THESE REQUIREMENTS CAN RESULT IN BUCKLING AND OTHER PROBLEMS. Laminate floors offer a wide variety of coordinating moldings and transition pieces to cover the 1/4" expansion space at walls, doorways and transitions to other flooring.

Some laminates have an attached foam underlayment on the planks while others require the installation of a separate underlayment.

When installing over any concrete subfloor, a moisture/vapor barrier must be installed first, if not already incorporated in the product.

Laminate flooring is intended for indoor use only.

General Subfloor Requirements:

The subfloor surface must be flat. Flat means no low spots or ridges more than allowed by the manufactures instructions.

The sub floor must be structurally sound and clean of debris.

The sub floor must be dry. (See specific requirements for wood and concrete below)

Patching compounds must be allowed to dry thoroughly before proceeding with the installation.

Laminate flooring can be installed above, on or below grade.

Do not install laminate flooring in rooms with a sump pump or floor drain. All sub floors must be checked for moisture. (See section on Moisture Testing)

Concrete sub floor:

New concrete must cure for at least 60 days.

All slabs must be flat to within manufacturer's recommendations.

Cover all concrete sub floors with a manufacturer approved vapor retarder. Overlap all joints 8" and install from wall to wall.

Slabs on, above, or below grade, and lightweight concrete need a vapor retarder.

Existing sheet vinyl, VCT, LVT, ceramic tile, and terrazzo installed over concrete require a vapor retarder and must-met flatness requirements. Any existing wood flooring glued to concrete must be removed prior to laminate installation.

Carpet and pad must always be removed prior to laminate installation. Any floating must be removed.

Wood sub floors:

Wooden sub floors must be constructed per local building codes, be structurally sound and deflection free.

Repair any squeaky floor prior to installation.

Sand or plane high spots.

Fill all low spots with Portland cement based patching compound.

Floor patch applied per the manufacturer's recommendations is a good choice to fill low spots, it is not necessary to use a vapor retarder on top of a wooden sub floor.

Room Preparation:

Be sure the room has the correct temperature *and relative humidity* for installing laminate flooring, as specified by the manufacturer.

Remove existing quarter round and replace them by appropriate color co-coordinating laminate finish quarter round that most manufacturers would offer/recommend.

Remove carpet, padding, and tack strip. Wood or parquet glued to concrete must be removed.

Undercut all door frames. Extend undercut approximately 1" beyond the door frame. (Quarter round will cover where wall base or drywall has been undercut).

Flatten sub floor as described in section on "General sub floor requirements".

Repair wood sub floors to eliminate squeaks or deflection.

Sweep or vacuum up all debris and foreign matter.

Roll out a vapor retarder from wall to wall, as specified in the manufacturer's installation instructions

If required, roll out a suitable underlayment. Roll out additional underlayment as the floor is installed.

Installation:

Layout the first row. It is an accepted industry practice to begin and end each row with a plank at least 8" long.

For plank designs, measure the width of the room and divide by *the width of* one plank. If the remainder is $2/x$ " or less, cut down the width of the first row to allow the last row to be more than 2" wide.

For tile and slate designs the width and length of the planks in the first and last rows should be balanced.

To balance the width of a pattern in a room, add the width of the last row to the width of a full plank and divide by two. The answer is the width of the first and last row. For example, if the last row is 5" wide, add 5" to width of the plank, in this case $11 \frac{1}{2}$ " to get $16 \frac{1}{2}$ " Divide by two and get $8 \frac{1}{4}$ " which is the size to cut the first and last row.

To install flooring around pipes, drill a hole in the plank $\frac{1}{2}$ " larger than the pipe diameter. *Cut the plank across the center of the circle, position on the floor* and glue the plank pieces back together. (Do not glue laminate to the sub floor). Cover expansion gaps with molding or pipe rings when the floor is complete. All pipes require silicone sealant in the expansion space.

To replace any planks that may have been damaged, simply raise the last installed board approximately 1" until it disengages. Replace and reinstall the planks. Do not engage and disengage more than three times.

Cutting the Last Row:

Place a full row of planks directly on top of the last installed row of planks. Use the full width of a scrap piece of plank. Place the tongue *side against* the wall and a pencil against the extended groove and mark a line the length of the wall. Cut along the pencil line. Leaving the tongue and groove on the scrap piece will automatically allow for the $\frac{1}{4}$ " expansion space needed.

Bathroom Installation:

Some laminate flooring manufacturer would recommend their product to be installed in a bathroom; however, it is very important to follow all instruction from the manufacturer and to prevent water or moisture from getting onto the flooring. Remove the toilet before installing the laminate flooring. Seal all expansion spaces including around the toilet flange and any pipes with mildew resistant 100% silicone sealant.

Kitchen Installation:

When installing laminate flooring in a kitchen all expansion spaces subject to moisture or plumbing leaks must be sealed using a mildew resistant 100% silicone sealant. Fill the expansion space in front of the sink and dishwasher, around the refrigerator and icemaker, exterior door/s and any other area subject to flooding. It is recommended that kitchen cabinets be installed prior to installing laminate flooring. Install the plank up to the kick plate of the cabinets, leaving an expansion space per manufacturer's instruction (generally from 5/16" to 3/8"). Cover the expansion space with a quarter round molding.

Staircases

Cut the stair nosing to the desired length and attach to the sub floor as per manufacturer's instructions.

Tread Flush or Even with Riser

The riser must be installed before the nosing *is* fit into place. If installing from a floating floor, follow the above instructions. When installing on a stair tread, the nosing will be installed after the tread and riser are glued into place.

Tread with an Extended Square Edge Nosing

On this style of tread, simply cut a narrow strip of laminate and glue it on the edge of the existing tread. Install the tread and the riser and finish the edge with a stair nosing.

Laminate on Stair Treads and Risers

Cut the laminate planks net from side to side, no expansion space is necessary. Remember that the depth of the laminate tread material will be cut to accommodate the width of the laminate nosing which overlaps either a riser of laminate or the piece of laminate which is glued to the edge of the step. One plank of laminate will finish most risers; if two planks are needed to accommodate the depth of the tread, position the joint close to the riser. After dry fitting the treads and risers, start with the bottom riser an install each step until the last top riser is installed. Start from the bottom of the stair, installing first the step and then the riser; the bottom of the riser piece should sit on top of the installed step, for a clean look. Use a premium adhesive to fix.

Stair Nose

Stair Nose is used to finish stair edges or step down applications.

Repairing Minor Damage to Laminate Floors:

Repairs, depending on depth and size of the damage, can be done with the use of marker pens, wood filler / colored filler, or board replacement. Follow manufacturer's recommendations.

NALFA Installation Requirements

(Always check product installation instructions and Manufacturer's recommendations)

Requirements (INTERIOR)	
Expansion Gap	Always leave at least ¼" up to ⅜" on the perimeter per manufacturer.
Transitions	A transition is recommended for door opening smaller than 6 feet. You should also break down floors larger than 25 feet in width of product or longer than 40 feet. For specific case, contact your product manufacturer.
Staggering of Head/End Joints	Minimum should be between 8 and 12 inches. Consult your product manufacturer's instructions.
Width of Last Product Row	Most manufacturers recommend not less than 2 inches.
Sealant Use	Close to wet areas (bathrooms, kitchen sinks, dishwashers, and refrigerators with icemaker, use flexible-cure silicone sealant. Perimeter of bathrooms should be also sealed. Some manufacturers have specific recommendations for installing in Wet Areas.
Subfloor Flatness	Most manufacturers recommend a maximum of ⅜" on a 6-foot radius.
Slope	Installing Laminate Flooring on slope is NOT RECOMMENDED.
Subfloor Moisture	Concrete Subfloor should be less than 5lbs/1000 sq. ft./24 hours. Wood floors should be less than 12% in moisture content.
Relative Humidity Requirements	Should be between 35 and 65 % at all time.
Acclimation	Although most manufacturers do not request for acclimation, some are asking up to 96 hours for acclimation. Consult your specific product installation instructions
Room Temperature	Keep temperature between 60° and 85° F
Underlayment Requirements	A 6-Mil Polyethylene film over concrete subfloor is required or appropriate Underlayment specified by manufacturer.
DO NOT	Do not wet mop; clean with water. Do not use waxes, oils or steam cleaners.

Requirements for Underfloor Heat	
Expansion	Always leave a minimum of ¼" to ⅜" on the perimeter per manufacturer
Transitions	A transition is recommended for door opening smaller than 6 feet. You should also break down floors larger than 25 feet in width of product or longer than 40 feet. For specific case, contact your product manufacturer.
Maximum Temperature at the Surface of the Floor	Never raise the flooring surface temperature above 85°F
Changes to Heat Settings	Maintain room temperature between 65° and 85° F. Throughout the life of installation, you should always try to limit the change in settings by no more than 5° F (degrees) per day.
Requirements (Exterior conditions)	
Crawl Space	Crawl space should be ventilated using 1.5 square feet of vent per 100 square feet of floor surface.
Ground Cover	Full coverage of the crawl space floor should be done with a 6-mil polyethylene film.
Gutters and Down Sprout	They should be in good condition and directing water away from the building foundations.
Outside Slope or Grade	Should be away from house.
Sprinkler Systems	Should be in good working condition, with no pooling areas adjacent to home walls and foundations.

Appendix A

Safety Guidelines

Safety First

Safety on the job is the foremost concern for contractors, because accidents with power tools can be critical, even disabling or deadly. No amount of experience or expertise exempts you from safety risks inherent in using the tools required to install laminate flooring. The good news is that these risks are easily managed. Start with these general guidelines:

1. Never work under the influence of alcohol, drugs or medication.
2. Work with others nearby, if possible.
3. Do not work on a cluttered floor.
4. Use proper lighting and ventilation.
5. Make sure that the electrical power and wiring at the jobsite is sufficient to operate all machines safely.
6. Know your insurance company's policy on coverage related to accidents or jobsite situations.
7. Wear proper work clothing and shoes. Do not wear loose clothing that could get caught in a machine.
8. Wear NIOSH-approved hearing protection and safety glasses, as well as dust and fume respirators, knee protection and gloves.
9. Have an OSHA-approved first-aid kit on the job site.
10. Read and fully understand the owner's manuals that are supplied with the equipment.
11. Use tools only as intended.
12. Use all tool and machine safety guards.
13. Turn off and unplug electrical tools and machines when adjusting and attaching accessories.
14. Turn off all sources of ignition when using flammables.
15. Use ground fault circuit interrupters (GFCIs) on electric tools to avoid electric shock.
16. Carry and read MSDS (Material Safety Data Sheets) for all products.
17. Do not exceed manufacturer's recommended working air pressure for pneumatic systems.

Appendix B

Radiant Heat Installations

Laminate Flooring products may be installed over underfloor heating provided the conditions listed below are met. The underfloor heating must consist of heating elements with either warm water or electrical resistances embedded in the subfloor. Electrical mats laid on the subfloor are not approved for use now.

Adhere to the following guidelines for a successful installation:

- All general installation instructions **must** be followed.
- Laminate flooring **must** be installed as a floating floor.
- Underlayment is required. Manufacturer's recommendation on underlayment should be preferred. Alternative foam underlayment (maximum 1/8" inch thickness) could be used but its suitability for underfloor heating must be verified independently.
- Choose an underlayment with the plastic moisture barrier film built-in or start with a minimum 6 mil poly/DPM (damp proof membrane) on the base floor. If using separate poly sheeting, try to use a single sheet, or, if more sheets are required, ensure they overlap each other by 1 inch and are securely taped together with waterproof tape.
- The maximum allowed heat resistance (R value) of the total floor covering is 0.8517 hr. ft². °F / BTU. Laminate flooring (9.5 mm, 8 mm, and 7mm) in combination with suitable underlayment are well under this maximum. Laminate flooring with attached pad may also be used over radiant heat providing all installation requirements are met.
- Be sure that the expansion gap between the floor and the wall, as well as the expansion gap around pipes, is at least ¼" (some manufacturers recommend at least 5/16"). **Do not exceed 35 feet in overall length or width unless recommended by the manufacturer.**

Concrete as a base floor:

- The installation of the concrete and the floor heating must be done per the instructions of the supplier of the floor heating and of the concrete.
- To obtain an even temperature all over the floor, the maximum distance between the heating elements is 1 foot. The depth of the pipes is defined by the heating manufacturer.
- The concrete must be sufficiently dry. Per the CM method, the moisture content should be less than 1.5%.
- Start up the heating gradually, 10°F a day, minimum 2 weeks before laying, and minimum 21 days after the installation of the concrete.
 - 50 % of the capacity during 2 weeks.
 - 100 % for the last two days.
- If the concrete is newly laid, please follow the instructions of your heating installer. A heating up protocol must be available and should be asked for.

Heating in general:

- At the time of installation, the temperature of the floor **may not exceed 64°F**.
- Wait at least 24 hours after installing the laminate before changing the temperature settings. Increase the temperature gradually, a maximum of 5°F a day.
- **Never raise the flooring surface temperature above 82°F for the life of the installation.**
- Throughout the life of the installation, the consumer should only increase or decrease temperature settings 5°F per day, so the laminate can adapt to the temperature changes in a gradual manner. Always change the temperature gradually at the beginning and ending of a heating season.
- Make sure that the atmosphere in the room does not become too dry during the heating season. Use a humidifier if necessary to maintain the relative humidity levels.
- At a temperature of 65-72°F, the relative humidity must be between 45-65 %.
- The end consumer should be aware that minor gapping between planks during the heating season is a normal occurrence with laminate over radiant heated subfloors. Proper humidity controls within the home will help to minimize this type of natural reaction to seasonally changing climate conditions.
- Accumulation of heat under an area rug or because of insufficient ventilation under furniture (example: overstuffed couch with floor drape) must be avoided. Do not use area rugs during the heating season.

Appendix C

White Paper: Flooring Underlayment Acoustics, Impact Insulation Classification

North American Laminate Flooring Association (NALFA)

The importance of acoustics is often forgotten until a building is completed. However, the 2010 California Green Building Standards Code (CalGreen Code) which took effect January 1, 2011 made it mandatory for all new construction in California (non-residential and residential up to three stories) to comply with certain acoustical control standards. The required sound mitigation performance is measured and classified in both of two standard methods defined as Sound Transmission Class (STC) and Impact Insulation Class (IIC). Why should you care – especially if you do not live or work in California? Well when it comes to building codes, as California goes, so does the rest of the country – at some point.

Minimizing impact and airborne sound in multi-family dwelling begins in the design phase. Several factors contribute to a room's sound insulating ability: 1) floor/ceiling/wall construction and room size and shape; 2) Interior décor, such as wall hangings and curtains and finishes and furnishings such as chairs, sofas, tables and rugs; 3) choice of floor covering material; 4) use of a flooring underlayment. The cumulative effect of all these components are what provides the final sound characteristics of the space. No single component can fulfill the requirements for building requirements, which consider the effects of the sum of these components.

Multi-family units are constructed using a variety of designs and material. The floor/ceiling area of a condominium could consist of a 4" to 12" reinforced concrete slab. The same suspended concrete subfloor could include a suspended ceiling. The suspended ceiling could include varying levels of sound insulating products like fiberglass or cellulose insulation. There may or may not be isolation barriers between the slab and the perimeter support walls. Wood frame construction may consist of just a plywood sub-floor over a solid plank or I-beam floor joist, or may include poured lightweight concrete on top and/or a suspended ceiling. Again, fiberglass or cellulose insulation might also be included either between the floor joists or in the suspended ceiling or both.

An often overlooked, but important factor involved in the noise level within the living space of a condominium unit is what happens to the sound vibration after it enters the unit below. Smooth walls and hard surface furnishings will allow sound waves to deflect or "bounce" from the surface, resulting in elevated noise levels within the unit. Upholstered furniture, area rugs, wall and ceiling finishes, and textile window dressings will help diffuse and absorb in-room sound, which will tend to lessen the intensity.

The popularity of hard surface flooring such as laminate, wood, and ceramic tile has elevated the interest in improving sound insulation in condominiums and other multi-family dwellings. The use of a sound deadening underlayment for hard surface flooring is important for impact sound such as footfalls, objects dropped on the floor, etc.

There are several different types of underlayment available on the market. With the many types of condominium construction, getting accurate sound deadening comparisons among different categories of underlayment in relation to their contribution to the sound isolation of an entire floor/ceiling assembly has been difficult.

The accepted sound test methods in North America are 1) Impact Isolation Class (IIC), ASTM E492/E989, for impact sound and 2) Sound Transmission Class (STC), ASTM E90/413 for airborne sound. Both tests are conducted in a laboratory setting and evaluate whole floor/ceiling assemblies, not just the underlayment involved in the test. Field test methods for testing actual condominium units are also available for each type of test (Field IIC/ Field STC).

An integral part of a sound test report for any given laboratory, whether it is a laboratory sound test or a field sound test, is a detailed description of the whole floor/ceiling assembly. When comparing IIC (impact) and STC (airborne) test results among the different types of underlayment it is important to make sure those underlayments were tested in identical floor/ceiling assemblies. In addition to the variables (listed above) involved in the floor/ceiling construction of condominium units, there may also be variations in construction among laboratory testing facilities. While physical dimensions of the floor/ceiling assembly and receiving chamber in a sound testing facility are fairly simple to measure, the exact density and quality of construction of the test floors along with the climatic conditions in those facilities are much more difficult to equalize. Additionally, some laboratories utilize a membrane to isolate the testing room slab. Those variations among the accredited sound testing laboratories make it difficult to accurately compare the results from one laboratory to the next, even when the description of the floor/ceiling assembly is the same.

One last variation to consider in sound test reporting is the margin of error or tolerance level involved in the execution of the test method. Most sound testing engineers will acknowledge a testing tolerance of a least +/- one IIC or STC unit to account for laboratory anomalies such as:

1) sample material variation, 2) slight differences in sample placement on the test surface 3) changes in temperature and/or humidity, 4) technique differences when more than one technician is used, etc.

The Delta IIC test (ASTM E-2179) is a variation of the IIC which can be used to isolate the contribution of the floor and underlayment to the total sound reduction. It can be performed with a standard concrete sub-floor and comparing the results of two different IIC tests; one with just the concrete slab and the other with the floor covering material and underlayment included. When you subtract the "slab only" IIC test from the IIC test that includes the flooring materials and underlayment, the result is an IIC number representing the change in (or Delta) IIC. For comparing the impact sound isolation ability of underlayments, the Delta IIC test allows for much more control over the many test variables. Typically, when evaluating IIC, it is desirable

to use a construction for the test in which all other components that affect the acoustic properties are minimized or eliminated. This allows the most accurate isolation of the effect of the individual component (underlayment) being evaluated. Because the other contributing components are eliminated from the test, the values obtained do not fully represent the sound reduction of the full typical construction that would be used for evaluation against the standards and is only used to create a common ground for comparison of the contribution of the underlayment materials themselves.

In an effort to more accurately evaluate the impact sound isolation characteristics of the various categories of laminate underlayment available to consumers, The North American Laminate Flooring Association (NALFA) recently conducted Delta IIC sound tests on eight different categories of laminate underlayment available in the market. The tests were conducted using the exact same testing facility, the exact same test floor ceiling assembly, and the exact same laminate flooring material. The only variable in the testing was the type of laminate underlayment.

Categories of underlayment included in the testing were: cork, crosslink polypropylene foam, polyethylene foam/film, froth urethane foam, synthetic fiber, crumbed rubber, beaded polystyrene, and extruded polystyrene. Representative samples for each category were submitted for testing.

Results are as follows:

Sample ID	Underlayment Type	Thickness	Density	Delta IIC
A	Cork	.08"	15.2lb/ft ³	20
B	XL PP Foam	.08"	3.1lb/ft ³	21
C	PE Foam/Film	.08"	2lb/ft ³	21
D	Froth Urethane	.08"	5.3lb/ft ³	22
E	Synthetic Fiber	.125"	13.3lb/ft ³	21
F	Crumbed Rubber	.08"	36lb/ft ³	21
G	Beaded Polystyrene	.094"	3.5lb/ft ³	23
H	Extruded Polystyrene	.094"	2.6lb/ft ³	21

With Delta IIC results of 20 to 23, all the laminate underlayment proved to significantly improve the impact sound isolation of the concrete subfloor. With a margin of error of +/- 1 unit, the difference among the eight categories appears to be statistically minimal.

For condominium residents interested in obtaining accurate information regarding sound deadening characteristics of underlayment for hard surface flooring, the North American Laminate Flooring Association recommends the following:

1. Make sure that the sound test results reported by underlayment manufacturers have had actual sound tests conducted. Ask for test reports.
2. Make sure those reports include an accurate description of the floor/ceiling assembly used in the test.
3. Extremely high reported sound test values for any underlayment product should be closely scrutinized.

LEGAL DISCLAIMER:

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Appendix D

Trim & Thresholds

Moldings Used with laminate Floors

Laminate floors require expansion space at the wall and all vertical obstructions. Moldings are used to cover the expansion area, to hide cut ends, to adjust height differences or transitions between floors and to aesthetically finish the area. Profiles are many and vary through the industry. Here are some examples of standard profiles.



Baseboard

Baseboard: from 3/8" and thicker, from 1½" and higher used to protect the wall and cover expansion space.



Baseshoe

Base Shoe: from 3/8" to 5/8" thick, from ½" to 1" high; used instead of baseboard or with baseboard too on vertical surfaces/bases to complete expansion coverage; flexible enough to conform to irregular surfaces.



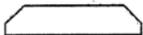
Quarter Round

Quarter Round: one quarter of a full round; from ½" to 1"; used as an alternative to base shoe in some areas.



Reducer

Reducer: from 5/16" to ¾" thick, 1" to 3½" + wide; used to transition in thickness from laminate floor down to thinner surface, generally through door openings. Also, used to cover expansion space around vertical surfaces such as fireplace hearths when mounted directly to surface of flooring.



Threshold/Saddle

Threshold: from 5/16" to ¾" thick, many widths; used to make the transition at doorways, between interior rooms and to the outside. Can be custom milled to any size.



T-Moldings

T-Moldings: 5/8" thick by 2" wide, beveled down on both sides with a T-configuration, used for transition from one hard surface floor to another.

Custom Moldings: Moldings created for unusual circumstances may be manufactured to job site requirements to complement the laminate floor and allow for proper transition and coverage of expansion space.

Appendix E

INSTALLER'S CHECKLIST: MAINTAINING CUSTOMER WARRANTY		INSTALLER'S CHECKLIST: LAMINATE FLOOR INSTALLATION	
	What Warranties apply to this Laminate Flooring:		These initial checks made upon arrival at customer's residence:
	Structural		Room measured to verify square footage
	X-Years Residential Wear		Correct flooring, underlayment and quantity
	X-Years Residential Stain		Correct moldings and quantity
	X-Years Residential Fade		Proper cleaning products ordered and delivered
	X-Years Residential Water		Flooring acclimatized minimum 48 hours
	X-Years Limited Commercial		
	I have checked for the following to ensure the warranty is valid:		These room checks made prior to beginning floor installation:
	Floor tolerance per Manufacturers' requirement		Subfloor moisture content checked and as per Manufacturer's recommendation
	Subfloor dry and sound		Room humidity checked and OK (35% to 65%)
	Proper relative humidity in home		Room temperature checked and OK (60° F to 85°F)
	Flooring acclimatized prior to installation		Floor flatness checked as per Manufacturer's tolerances
	Proper underlayment selection and installation		Subfloor dry, sound, flat
	Expansion gap around all perimeter walls		All imperfections repaired
	Visual Defects – boards with surface imperfections removed before installation		Number of necessary transitions determined
	Planks inspected for damage to joint prior to installation		
	Planks shuffled for maximum visual appeal		The following preparation has been done before starting floor installation:
	Joint free of dirt, dust, foreign objects		Tool kit checked to confirm all necessary tools, and in proper working order for installation
	Gaps filled with silicone in all bathroom applications		Installation Kit components checked
	Transition moldings as recommended by Manufacturer, including all doorways		All existing room moldings removed from walls
	Floor properly cleaned with recommended Maintenance Products and protected while on site		Nails removed from existing room moldings
	Warranty information left with customer		Doors checked for clearance
	Customer thanked for installation opportunity!		Doorframes and all irregular surfaces undercut
			Floor swept to remove dust, dirt, foreign objects

Glossary

1. **Acclimation:** Adaptation of the laminate floor to its installation environment or in accordance with specific pretesting requirements
2. **Acoustical Properties:** Absorbance, reflection or transmission of sound waves generally measured in terms of Impact Insulation Classification(IIC), Sound Transmission Classification(STC) or difference between Concrete substrate IIC and IIC of same concrete assembly with finished laminate floor installed (Delta IIC).
3. **Adhesion:** A chemical process by which two materials can be joined together.
4. **Antistatic:** Ability to limit the accumulation of static electricity on a surface.
5. **Backer:** Layer of the Laminate floor covering that provides balance, generally bonded to the bottom of the core layer
6. **Balanced Construction:** A Laminate tile or plank construction that has materials of similar properties (Stiffness, Dimensional stability, etc.) bonded to both sides of the product.
7. **Bond:** See Adhesion.
8. **Chemical Resistance:** See Stain Resistance.
9. **Colorfastness:** The ability of a material to retain its original color upon exposure to light or other source of degradation (i.e., light resistance).
10. **Core:** The material layer which provides thickness, dimensional stability and other properties needed for the Laminate flooring product. Note - The core layer generally consists of HDF/MDF (High Density Fiberboard/Medium Density Fiber Board) material and is in the middle of the other Laminate product layers (e.g. Overlay/décor/core/backer).
11. **Crook:** A specific type of warp, when a tile, or plank has a curvature from end to end, edgewise, from a straight line (i.e., banana).
12. **Crowning:** A specific type of warp when a tile or plank assumes an inverted "U" shape along the length and or width dimensions of the face (i.e., convex). Sometimes referred to as bowing or horns down
13. **Cupping:** A specific type of warp where a tile or plank ~~panel~~ assumes the shape of a "U" along the length and or width dimensions of the face (i.e. concave). Sometimes referred to as end lift or horns up
14. **Décor Layer:** The layer of laminate flooring providing visual aesthetic properties.
15. **Deflection:** The bending of a material between supports when a load is applied.
16. **Delaminating:** Separation of the Tile or plank layer(s).
17. **Density:** Unit weight per volume of a tile or plank expressed in lb./ft.³ or kg/m³
18. **Dent:** A depression with or without a fracture of the Laminate surface.

19. **Dimensional Stability:** The ability of a material to resist changes in measured dimensions caused by environmental factors (e.g., moisture and/or temperature)
20. **Direct Press Laminate (DPL):** A Laminate flooring produced where the overlay, décor core and backer are bonded together in a single step.
21. **Embossing:** A process by which the surface of the Laminate flooring is given a texture.
22. **Equilibrium Moisture Content:** The moisture content at which the material neither gains nor loses moisture at a given relative humidity.
23. **Expansion Gap:** A space necessary between fixed objects (i.e. walls of a room, pipes, and cabinets) and between the material itself to allow for the movement of the material.
24. **Fabricator** Any person or entity who uses composite wood products to make finished goods e.g. Laminate flooring, etc.
25. **Medium Density Fiberboard(MDF):** A core material primarily composed of cellulose fibers combined with synthetic resins or other suitable bonding systems under heat and pressure. The materials are usually designated as low, medium, or high density (e.g., LDF, MDF or HDF). Note: High Density Fiberboard (HDF): A fiberboard with density greater than 800 kg/m^3 (50 lb./ft.^3).
26. **Flame Spread:** Measurement of the flame propagation along the surface of a material.
27. **Floating Floor:** Installation method by which the flooring panels are connected and not attached to the subfloor.
28. HDF (High Density Fiberboard) – See MDF (Medium Density Fiberboard)
29. High Pressure Laminate (HPL): A Laminate Flooring product where material layers are consolidated under heat and pressure exceeding 5.17 MPa (750 psi).
30. **Impact Resistance:** Ability to resist fracture or damage from a falling object.
31. **Inlay:** A decorative effect used in flooring by combining elements of the same material but with different colors or patterns (e.g., borders or feature strips).
32. **Laminate Flooring:** A rigid floor covering, typically in a plank or tile format, having a multiple layer product structure, e.g., overlay, décor, core and backer. The planks/tiles have worked edges that allow the product to be joined together to form a larger integral unit. The product may vary in surface texture and gloss. Laminate flooring does not include products having a resilient, stone, textile, wood, leather, or metal top surfacing material(s).
33. **Ledging:** – Surface height difference between adjoining like planks or tiles, on opposing sides of square edged or beveled joint, at the time of installation, sometimes referred to as overwood.
34. **Moisture Content:** The amount of water in the material, usually expressed as a percentage of the dry weight.
35. **Moisture Meter:** A tool used to measure moisture in the air, substrate or product
36. **Overlay:** Top layer of a laminate floor which provides wear resistance and other surface performance attributes. (See Surface layer).

37. **Pattern End Matched:** When the ends of the flooring tiles or planks, typically similar patterns, are matched end to end to yield a continuous linear effect.
38. **Peaking:** Areas of the laminate flooring at adjoining tile or plank panel seams that have risen above the intended horizontal plane of the flooring surface.
39. **Plank:** A Laminate flooring element (single piece) three or more times longer than wide.
40. **Pressing:** A manufacturing process by which material layers, used to produce a Laminate flooring product are consolidated using pressure, generally in the presence of heat.
41. **Residual Indentation:** The difference between the initial thickness and the final thickness after performing the static load test.
42. **Resins:** A polymeric material (e.g. melamine or urea, etc.) used for impregnating and bonding layers of laminate flooring.
43. **Seam(s):** A line or junction where Tiles or Planks are connected.
44. **Stain Resistance:** The degree to which a material resists permanent discoloration or surface attack from exposure to household items and/or industrial chemicals or reagents.
45. **Subfloor/Substrate:** A pre-existing supporting surface used in a building or structure over which a laminate flooring can be installed
46. **Surface Layer:** The outermost layer of laminate flooring designed to be the visible side when installed (i.e. overlay or wear layer).
47. **Tile:** A laminate flooring element (single piece) less than three times longer than wide.
48. **Thermofusing:** A process where resins are consolidated under heat and pressure to create a permanent bond and develop certain strength properties.
49. **Underlayment:** A material used between the laminate flooring and the subfloor (e.g., foam padding). Note - some Laminate flooring has the underlayment integrated into or attached directly to the Laminate flooring.
50. **Warp:** See Crowning, cupping, or crook.
51. **Wear Resistance:** Ability of the laminate flooring surface to resist abrasive wear through its overlay and décor layer.
52. **Wear Layer:** See (Surface layer)

NALFA Members

Armstrong Flooring
IVC US
Kronospan
Mannington Mills
Mohawk
Pergo®
Quick-Step®
Shaw Industries, Inc.
Swiss Krono
Torlys, Inc.