INSTALLATION
INSTRUCTIONS

Installer/Owner Responsibilities

Beautiful hardwood floors are a product of nature and therefore have variations that are natural for the product. Allwood wood floors meet or surpass accepted industry standards, which permit a defect tolerance not to exceed 5%. The defects may be of a manufacturing or a natural type.

- The installer assumes all responsibility for final inspection of product quality. This inspection of all flooring should be done before installation. Carefully examine flooring for color, finish and quality before installing it. If material is not acceptable, do not install it and contact the seller immediately.
- Prior to installation of any hardwood-flooring product, the installer must determine that the job-site environment and the sub-surfaces involved meet or exceed all applicable standards and recommendations of the construction and materials industries. These instructions recommend that the subfloor be dry, stiff and flat, thermostat/humidistat set to regular living setting and the flooring acclimated under this setting. The manufacturer declines any responsibility for job failure resulting from or associated with sub-surface or job-site environment deficiencies.
- During installation, the installer must use reasonable selectivity and hold out or cut off pieces with defects, whatever the cause. Should an individual piece be doubtful as to grade, manufacture or factory finish, the installer should not use the piece.
- Use of stain, filler or putty stick for defect correction during installation should be accepted as normal procedure.
- When flooring is ordered, add 5% to the actual square footage needed, for cutting and grading allowance.
- Use of appropriate products for correcting subfloor voids should be accepted as a normal industry practice.
- Follow NWFA Installation Guidelines if any of the instructions in this manual differ from or conflict with the former.

BEFORE YOU START

Tools & Accessories Needed

Must-haves

- Hygrometer
- Moisture Meter
- Chalk line & chalk
- Tape Measure
- Square
- Miter, Jig/Table & Jamb Saw
- Safety Glasses
- Tapping Block, Hammer & Bar
- Wedges
- Masking Tape

For Glue-Down

- Glue-Down Adhesives (Determined by the jobsite conditions, subfloor, etc.)
- Adhesive Cleaner
- Trowel

For Nail/Staple-Down

- Stapler/Cleat Nailer & Nails
- Air Compressor if Pneumatic Nailer

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Pre-Installation Procedures

Job Site Inspection

- The building should be closed in with all outside doors and windows in place. All concrete, masonry, framing members, drywall, paint and other "wet" work should be thoroughly dry.
- The wall coverings should be in place and the painting completed except for the final coat on the base molding. When possible, delay installation of base molding until flooring installation is complete.
- Exterior grading should be complete with surface drainage directing water away from the building. All gutters and downspouts should be in place.
- Basements and crawl spaces must be dry and well-ventilated.
- Crawl space must be a minimum of 24" (600 mm) from the ground to the underside of the joists. A ground cover of 6-8 mil black polyethylene film is essential as a vapor barrier with joints lapped six inches and taped. The crawl space should have perimeter venting equal to a minimum of 1.5% of the crawl space square footage. These vents should be properly located to foster cross ventilation.
- Subfloor must be checked for moisture content (MC) using the appropriate testing method.
- Air conditioning and heating systems should be in place and operational. The thermostat and humidistat should be set at normal living levels, with recommended temperature of 60-75° F and relative humidity (humidity) of 30-50%, at least seven days prior to installation. This humidity range between 30% and 50% should be maintained during acclimation, installation, and after installed.

Storage & Acclimation

- Handle and unload cartons with care. Cartons should be stored on "on-grade" concrete floors, in a location with at least a four-inch air space under the cartons. Flooring should not be delivered until the building has been closed in, with windows and doors in place and until cement work, plastering and all other "wet" work is completed and dry. Concrete should be at least 60 days old.
- Acclimate the flooring under **occupied conditions** until the flooring's MC (moisture content) and temperature reach equilibrium of moisture content (EMC), which may take 1 to 4 weeks, depending on the environment and the flooring. Within the recommended range of temperature (60°-75° F) and relative humidity (RH) (30% - 50%, or 35% - 55%), the EMC is primarily a function of the relative humidity and can be estimated by using the chart below:

Relative Humidity (%)	30	35	40	45	50	55	60
EMC (%)	6.2	6.9	7.7	8.5	9.2	10.1	11

- Determine the indoor RH range and the corresponding EMC in the home/construction. The indoor RH range depends on local weather conditions, cooling/heating system used, and living habits. In some extremely humid or dry locations or on extremely dry or humid days, additional dehumidification or humidification may be needed to keep the RH within the 30% - 50% range.
- Acclimate the flooring MC to 1/3 – ½ of the EMC range from the lower level. For example, if the humidistat is set to 40% and the indoor RH fluctuates between 35% and 45%, then the flooring MC should be around 6.9% - 8.5% before installation.
- For solid flooring acclimation, open the packages onsite, under occupied conditions. Normal acclimation time is 10-14 days, but more time may be required, depending on the environmental conditions as compared to the flooring MC level. Measure the flooring MC before installation to ensure the flooring is properly acclimated.
- For engineered flooring, do not open packages until you are ready to install. Acclimate engineered flooring inside the box prior to installation.

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Doorway & Wall Preparation

Undercut door casings. Remove, if any, existing base, shoe molding or doorway thresholds. These items can be replaced after installation. All door casings should be notched out or undercut to avoid difficult scribe cuts.

Inspect the Flooring before Installation

Real wood, cork and bamboo flooring contains natural variations in color and grain pattern. In order to prevent color grouping or repetitive grain patterns in the finished floor, it is recommended that boards be racked (sorted to be visually pleasing) before the floor is permanently installed.

- Immediately prior to installation, unpack 1 to 3 cartons to get a sense of the range of color variation and arrange the planks to achieve a satisfactory appearance (rack the boards).
- When racking, inspect all boards for visible manufacturing defects. Do not install any defected boards. Boards with manufacturing defects in excess of industry standards (5% of total quantity) may be replaced by the dealer under the terms of the product warranty. Once installed, boards will be considered to have been accepted by the customer and will not be eligible for replacement (See Warranty for details).
- Be attentive to staggering the ends of boards in adjacent rows at least 6" when possible. This will help ensure a more pleasant overall appearance of the floor.

Subfloor Types and Requirements

See **Appendix A.** in this manual.

Radiant Heat

See **Appendix B** in this manual.

Estimate Dimensional Movement

See **Appendix C.** in this manual**.**

Sound Control

See **Appendix D.** in this manual**.**

Moisture Testing and Vapor Retarders

See **Appendix E.** in this manual**.**

References:

This Allwood Installation Instruction Manual is created based on the National Wood Flooring Association (NWFA) Installation Guidelines (updated Sept, 2012). These guidelines by NWFA are regularly reviewed by a committee of industry experts, offering industry-accepted standards for hardwood flooring techniques. Follow NWFA Installation Guidelines if any of the instructions in this manual differ or conflict from the former. Contact your local distributor if you need a copy of the guidelines.

Appendix A. Subfloors and Requirements

The general requirement for Subfloors is flat, dry & structurally sound. Under these criteria, wood panels/solid board, concrete slab and other existing floor covering materials can all be used as subfloor.

Wood Panels/solid board

The subfloors must be flat.

- For nail/staple down installations, the subfloor should be flat to within ¼" in 10 feet or 3/16" in 6 feet radius.
- For glue-down installations and installations using mechanical fasteners of less than 1½", the subfloor should be flat to within 3/16" in 10 feet or 1/8" in 6 feet radius.
- Edge swell should also be flattened. This can usually be accomplished by using an edger sander.
- Make sure the subfloor is free of debris before beginning installation.

The subfloors must be dry

- Installers should know the MC of the subfloor and the flooring. There should be no more than 2 percent difference in MC between properly acclimated wood flooring and subflooring materials before installation.
- Ensure that there is proper expansion space (1/8") between the panels. If the subfloor panels are not tongue and grooved and if there is not sufficient expansion space, use a circular saw to create the specified space. Do not saw through joints on T&G subfloors.

The subfloors must be structurally sound

- Inspect the subfloor carefully. If there is movement or squeaks in the subfloor, refasten the subfloor to the joists in problem areas. Protruding fasteners are easily remedied by driving those fasteners deeper into the subfloor.
- Check for delaminated or damaged areas and repair those areas as needed.
- Acceptable Panel Subfloors:

    - On truss/joist spacing of 16" (406mm) o/c or less, the industry standard for single-panel subflooring is minimum 5/8" (19/32", 15.1mm) CD Exposure 1 Plywood subfloor panels (CD Exposure 1) or 23/32 OSB Exposure 1 subfloor panels, 4' x 8' sheets.
    - On truss/joist spacing of more than 16", up to 19.2" (488mm) o/c, the standard is minimum ¾" (23/32", 18.3mm) T&G CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4' x 8' sheets, glued and mechanically fastened, or minimum ¾" (23/32", 18.3mm) OSB Exposure 1 subfloor panels, 4' x 8' sheet glued and mechanically fastened.
    - Truss/joist systems spaced over more than 19.2" (488mm) o/c up to a maximum of 24" (610mm) require minimum 7/8" T&G CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4' x 8' sheets, glued and mechanically fastened, or nominal 1" OSB Exposure 1 subfloor panels, 4' x 8' sheets, glued in accordance with the truss/joist manufacturer's recommendations and with local building codes. Some truss/joist systems cannot be cross-braced and still maintain stability.
    - For double-layer subfloors, the first layer should consist of nominal ¾" (23/32", 18.3mm) CD Exposure 1 Plywood subfloor panels (CDX), 4' x 8' sheets or nominal ¾" (23/32", 18.3mm) OSB Exposure 1 subfloor panels, 4' x 8' sheets. The second layer should consist of nominal ½" (15/32", 11.9mm) CD Exposure 1 plywood subfloor panels, (Exposure 1) 4' x 8' sheets. The ½" plywood should be offset by ½" panels in each direction to the existing subflooring. The panels may also be laid on a diagonal or perpendicular, with 1/8" spacing between sheets. Nail on a 12" minimum grid pattern, using ring shank nails or staples.
    - Typical panel spacing and fastening requirements for truss/joist systems call for approximately 1/8" expansion space around the perimeter of each panel, with panels fastened every 12" (305 mm) along intermediate supports.

- Acceptable Solid Subfloors:
  - Allwood Solid Hardwood Collection (3/4" in thickness) can be installed directly over solid-board subflooring. Other collections must have a 3/8"or better plywood underlayment installed over solid board subflooring.
  - Solid board subflooring should be: ¾" x 5½" (1" x 6"), Group 1 dense softwoods (SYP, Doug Fir, Larch, etc.), No. 2 Common, kiln-dried.
  - Solid-board subflooring should consist of boards no wider than 6 inches, installed on a 45-degree angle, with all board ends full bearing on the joists and fastened with minimum 8d rosin-coated or ring-shanked nails, or equivalent.

Concrete Subfloors

The subfloors must be flat

- Flatness tolerance of 1/8"in a 6-foot radius and or 3/16" in a 10-foot radius. Many high spots can be removed by grinding, depressions can be filled with approved patching compounds, and slabs also can be flattened using a self-leveling concrete product.
- When sanding or grinding concrete, care must be taken to minimize the amount of silica dust produced. OSHA recommends using dust-collection devices, or applying water to the concrete before sanding. Approved respirators may also be used to minimize the amount of silica dust inhaled.
- The surface should be free from non-compatible sealers, waxes, oil, paint, drywall compound, etc. Check for the presence of sealers by applying drops of water to the slab. If the water beads up, there may be sealers or oils.
- Burnished or slick slabs may require screening or sanding with a 30-grit abrasive.

The subfloors must be dry

- NWFA guidelines specify using relative-humidity testing (ASTM F2170), calcium chloride testing (ASTM F1869) or calcium carbide (CM) testing (ASTM D4944 and MilSpec CRD-C154-77) to identify the MC of the slab.
- Use an impermeable vapor retarder with a perm rating of .13 or less, such as 6 mil polyethylene film.

The subfloors must be structurally sound

- Minimum 3000 psi.
- Over lightweight concrete (less than 3000 psi), if the flooring adhesive used has a higher shear strength than the concrete, use the floated subfloor installation method.
- If the psi of the concrete is unknown, use the floated subfloor installation method or contact the adhesive manufacturer. Rule of thumb: Draw a nail across the top; if it leaves an indentation, it is probably lightweight concrete.
- Do not attempt to glue a wood floor over a chalky or soft concrete slab.
- Allwood engineered and solid flooring collections cannot be installed directly over screed system, but the screed system needs to be overlaid with proper subflooring. The screed system must be overlaid with 23/32" Exposure 1 plywood subfloor panels, or 19/32" (15.1mm), Exposure 1 plywood subfloor panels or 23/32" OSB Exposure 1 properly spaced and oriented perpendicular to screed direction, and across two or more spans.

Other Existing Surfaces as Subfloors

Acoustic Concrete (For Floating or Glue Down Installation Only)

Acoustic concrete normally contains large quantities of gypsum that may inhibit the adhesive's capability to properly bond. For glue-down applications, acoustic concrete must be primed with the concrete manufacturer's recommended primer/surface hardener.

Resilient Tile, Resilient Sheet Vinyl & Cork Flooring (For Floating or Glue Down Installation Only)

If the tiles or sheet goods are well bonded, the flooring can be glued directly to the surface. Clean the surface thoroughly with a good quality household detergent. De-gloss flooring as necessary to create a good adhesive bond using an abrasive pad. If vinyl appears to have a coating of wax or other maintenance materials, it must be removed with the appropriate floor stripper. Allow ample drying time. (Note: Do not sand any resilient products for they may contain asbestos fibers, which may be harmful.) Do not direct glue to floors that exceed two layers; install as a floating system only under these circumstances. Cork floors must have all sealers and surface treatments removed before installation begins if a direct glue-down application is preferred.

Ceramic, Terrazzo, Slate & Marble (For Floating or Glue Down Installation Only)

All grout joints and broken corners that exceed 1" must be filled with leveling compound mixed with Latex additive of a glue-down application is preferred. The surface should be cleaned and abraded to create a good bonding surface for the adhesive. Loose tiles must be re-adhered to the subfloor or filled as above for both glue-down and floated applications.

Cork (Acoustic) (For Floating or Glue Down Installation Only)

Floating floors can be glued or floated directly over full-spread, permanently bonded acoustic cork. The cork should have a density of no less than 11.4 lb. /cubic foot and no more than 13 lb. /cubic foot. The cork, in general, should be pure cork combined with a polyurethane binder. Cork thickness is to be no more than ¼" (6 mm). Install cork in accordance with manufacturer's recommendations. Do not use cushion underlayment when floating over cork surfaces.

Installing Wood Panels Over Concrete

Floated Subfloor

- Add vapor retarder before applying underlayment, unless the underlayment is a vapor retarder itself, such as the All-in-One Premium Underlayment from Allwood.
- Panel Material: 2 layers minimum 3/8” (10mm) minimum CD Exposure 1 Plywood subfloor panels (CDX) 4’ x 8' sheets.
    - Installation:
        - Place the first plywood layer with edges parallel to wall, without fastening. Leave ¾” space between wall and plywood.
        - Lay the second layer perpendicular or at 45 degree angle to the first.
        - Plywood panels should be placed with 1/8” gaps between sheets and a ¾” minimum expansion space at all vertical obstructions and wall lines.
        - Staple/screw and glue (with urethane or construction adhesive) the second layer to first layer on 12” interior grid pattern (6” on the perimeter). Be careful not to penetrate the vapor retarder.
- Alternate Wood panels: Use minimum ¾” (23/32”, 18.3mm) CD Exposure 1 Plywood sheathing, 4’ x 8’ sheets.
    - Installation
        - Cut sheets to 16” x 8’ or smaller panels, scored on back 3/8” deep a minimum of every 12” across width.
        - 16” planks oriented perpendicular or diagonall~~y~~ to direction of flooring.
        - Panels staggered every 2’, and spaced 1/8” between ends, with ¾” minimum expansion space at all vertical obstructions.

Glue-Down Subfloor

- Always follow the adhesive manufacturer’s recommendation for proper subfloor, spread rate and trowel notch.
- Add vapor retarder before applying underlayment.
- Panel Material: Use minimum ¾” (23/32, 18.3mm) CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4’ x 8’ sheets.
- Installation: Cut the plywood panels to 2’ x 8’ or 4’ x 4’ sections.

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Appendix B. Radiant Heat Installations

BEFORE
YOU START

Allwood Engineered Hardwood Collections and Classic Bamboo Engineered Collection can be installed over radiant heat as long as the guidelines below are followed. Bamtastic Collection is water resistant so it can be installed without following the guidelines.

Understand Radiant Heat

The Floor MC and Environment Control

With radiant heat, the heat source is directly beneath the flooring, so the flooring may dry out faster than a similar floor in a home with a conventional heating system. Wood flooring can be installed over radiant heat as long as you understand radiant heat and how it can impact wood flooring, what precautions to take, and what type of wood flooring to use.

Scenario I. Radiant Heat as dry heat to the floor
Assumptions:

- Proper vapor retarder has been installed to prevent excess humidity moving towards the flooring from beneath the flooring when it is heated.
- The subfloor has been properly acclimated to have the same MC as the floor or to be within 2% variation (eliminated another humidity source towards the floor).

Under this dry heat scenario, assume the floor is installed and heated up to 85° F, and the room temperature is maintained at 68° F, then the floor EMC will be about

- 4% @ 30% indoor humidity
- 5% @ 40% indoor humidity
- 6% @ 50% indoor humidity
- 7% @ 60% indoor humidity

Once the heat is turned off, and the room temperature is maintained at 68° F, then the floor EMC will be about

- 6.2% @ 30% indoor humidity
- 7.7% @ 40% indoor humidity
- 9.2% @ 50% indoor humidity
- 11% @ 60% indoor humidity

Clearly, the floor should be acclimated to below 7% before installation.
The indoor humidity should be maintained at 50% - 60% or no less than 40% once the heat is turned on.
The indoor humidity should be maintained at 30% - 40% or no more than 50% once the heat is turned off.

Scenario II. Radiant Heat as humid heat to the floor
Assumptions:
Excess humidity from underneath the flooring is heated and moving towards the flooring.
The subfloor has high MC (as another humidity source towards the floor).
Under this humid heat scenario, moisture may accumulate between the radiant heat and the flooring, reaching saturation point (EMC up to 20%) for a period of time until the humidity is exhausted. The flooring would have high MC on the bottom side and lower MC on the top surface, which may cause the floor to buckle, cup and rupture.

Once the moisture is exhausted, the humid heat becomes dry heat, and Scenario I comes into play. The flooring will be dried to below 7% MC. Surface checks may appear, plus the remaining cupping. The wet-dry cycle may

cause the floor to delaminate, which is most often the wood failure than the glue, because the glue used in the engineered flooring can mostly tolerate the severe condition.

Clearly, the humid heat is to be avoided by using proper vapor retarder and dry subfloor, or a system to avoid the moisture accumulating under the flooring. Dry heat at higher indoor humidity and heat off at lower indoor humidity are the right settings.

Turning on the Radiant Heat

To minimize the effect of rapid changes in temperature on the MC of the wood floor, the heating process should be gradual. Basically, the rate of moisture loss will increase at lower indoor air humidity and higher floor temperature.

Scenario III. Assume dry heat, indoor air temperature 60° F

- @ 60% humidity of indoor air, the floor EMC is
  - 9.3% @65° F floor temperature
  - 8% @70° F
  - 7% @75° F
  - 6% @80° F
  - 5.5% @85° F

- @ 50% humidity of indoor air
  - 8% @65° F floor temperature
  - 7% @70° F
  - 6.2% @75° F
  - 5.4% @80° F
  - 4.8% @85° F

Clearly, the floor temperature can be increased faster when indoor air humidity is higher.
Suggestion: Use other heat source to keep the indoor air at 68 ° F or normal living temperature during installation and before turning on the radiant heat.

Scenario IV. Assume dry heat, indoor air temperature 50° F

- @ 60% humidity of indoor air, the floor EMC is
  - 7.0% @65° F floor temperature
  - 6.1% @70° F
  - 5.4% @75° F
  - 4.7% @80° F
  - 4.1% @85° F

- @ 50% humidity of indoor air
  - 6.1% @65° F floor temperature
  - 5.3 % @70° F
  - 4.6% @75° F
  - 4.1% @80° F
  - 3.5% @85° F

Clearly, the floor temperature should be increased at lower rate when indoor air temperature is lower.
Suggestion: Use other heat source to keep the indoor air at 68° F or normal living temperature during installation and before turning on the radiant heat.

Radiant Heat Installation Guidelines

1. The maximum allowable subfloor surface temperature is 85° F.
2. Even distribution of the heat – heating system and subfloor materials:

- With water-heated radiant-heat systems, a pressure test must be performed and documented by a qualified plumber or the system installer prior to beginning the installation of the wood flooring.
- Electric under floor systems should also be tested prior to floor installation. Check heat system manufacturer guidelines.
- If flooring materials that conduct heat at different rates are on the same circuit or heating zone, check with the HVAC mechanical engineer and Radiant Panel Association before proceeding.
- Radiant-heated subfloor systems can be concrete, wood or a combination of both, as long as the material will distribute heat evenly.

3. The vapor retarder and the subfloor MC:

   - Humid heat is to be avoided by using proper vapor retarder and dry subfloor, or a system to prevent moisture accumulation under the flooring.
   - A 6 mil or better polyethylene vapor retarder and a foam or resilient underlayment should be installed over subfloors. For best result, use Allwood "All-in-One" underlayment for floating installation.

   - Turn the heat on, regardless of the season, and leave it on for at least 5-6 days until the subfloor MC has dropped below 9%. Turn off the heat before the installation of the flooring begins, so the adhesive does not cure too quickly.

4. The floor MC
   The ex-factory MC of Allwood flooring is 7% on average, with limited moisture gain or loss (1%) during transportation and storage before the boxes are opened. The floor should be acclimated to 6% - 7% before installation.
5. Indoor Humidity Control
   Heat on at higher indoor humidity and heat off at lower indoor humidity are the right settings.
   - The indoor air humidity should be maintained at 50% - 60% or no less than 40% once the heat is turned on. For example,
     - With radiant heat on at 85^{o}F, the floor EMC is about 7% at 60% indoor air humidity and at 68° F temperature, EMC 6% at 50% humidity, and EMC 5.4% at 40% humidity.
   - The indoor air humidity should be maintained at 30% - 40% or no more than 50% once the heat is turned off. For example,
     - With radiant heat off, the floor EMC is about 6.2% at 30% indoor air humidity, EMC 7.7% at 40% humidity, and EMC 9.2% at 50% humidity.
6. Installation Methods
   - Floating installation is recommended. Expect some heating season shrinkage and cooling season expansion. The flooring should be installed at the median MC between the lowest and highest EMC of the on and off heating season. For example, if you would like to control the humidity to 40% year round, the EMC will be between 5.4% - 7.7%, and the suggested floor MC at installation is 6.5%.
   - Staple/nail and glue-down installation can be used if dry heat is achieved and the indoor air humidity can be controlled within a very tight range, about 50-60% at heating season and 30%-40% at off heat season. Be sure fasteners are not so long as to penetrate heating tubes or heat sources for nail/staple down installation. Make sure the moisture induced by the glue is dissipated before the radiant heat is turned on when using glue down method.
7. Use the glue formulated for radiant heat. Read the label on the bottle or consult the manufacturer.
8. Turn on the Radiant Heat
   - To minimize the effect that rapid changes in temperature will have on the MC of the wood floor, the temperature difference between the flooring and the indoor air should be kept at less than 10° F during the heating up process.

   - As the indoor air is heating up, the humidity will decrease if there is not adequate humidification control. Make sure to maintain the humidity at the acceptable level as the temperature increases.

   - The floor temperature can be increased faster when indoor air humidity is higher.

Appendix C. Estimate Dimensional Movement

- Hardwood flooring will shrink when it loses moisture to the surrounding air, and will expand when it gains moisture.
- Under the same environmental conditions, solid flooring will shrink or expand more than engineered flooring.
- The shrinkage coefficient for engineered flooring is unavailable from publications, due to structural differences of various kinds of engineered flooring and species used. A reasonable estimate is that engineered flooring will shrink or expand half as much as the solid flooring under the same environmental conditions. Allwood is not responsible for the actual shrinkage variation of engineered flooring from this estimation due to the unproven nature of it. Do experiment or have the experiment done when a more accurate estimate is needed.
- To estimate the potential dimensional changes of the solid wood flooring, you need to know the interior relative humidity (RH) variation range after the flooring is installed ~~in~~. A humidistat or hygrostat will regulate the interior RH range and give you the data to calculate the potential dimensional movement of the flooring.
- Potential Dimensional Movement can be estimated by the following:
    - Potential dimensional movement = shrinkage coefficient of the wood species x MC change x the width of the flooring.
- For example, 3 ¼" solid oak (mostly flatsawn) is acclimated to 7% MC before installation, for a room of 20' in width (about 77 rows). The interior humidity is to be controlled between 30% and 50% (EMC 6.2 – 9.2%) year round (with the help of air conditioning or additional humidification / dehumidification equipment if needed).
  Known:
  shrinkage coefficient = 0.00365,
  mc change @30% humidity = -0.8%
  mc change @50% humidity = 2.2%
  then, accumulated potential dimensional change

  @30% RH, 0.00365*(-0.8)*240 = -0.7" (shrinking) (less than 1/64" per board)
  @50% RH, 0.00365*(2.2)*240 = 1.9" (expansion) (less than 1/32" per board)

- The potential dimensional change will be restrained by the neighboring boards, and will cause buckling/cupping/rupturing if too much expansion occurs or gapping if too much shrinkage occurs.
- The rule of thumb is to control the RH within 20% variation which corresponds to 3% MC change, and the floor should be installed at a MC that is 1/3 – ½ from the lower end of the range.
- If MC of the floor is at the lower end of occupied RH range at the time of installation, spacers may be needed to allow future expansion. For example, if the flooring in the example above is installed in an interior with RH range 40% -60% (EMC 7.7 – 11), then the potential dimensional change will be up to 3.5" (3/64" per board). You may consider installing a spacer every a few rows.

Appendix D. Sound Control

When installing wood floors (hard surface flooring) in multi-family dwellings, it is necessary to take into consideration the sound control requirements. The BOCA National Building Code, 1996, has the following section for sound control:

- 1214.2 Air-borne noise: Walls, partitions and floor/ceiling assemblies separating dwelling units from each other or from public service areas shall have a sound transmission class (STC) of not less than 45 for air-borne noise when tested in accordance with ASTM E90.
- 1214.3 Structure borne sound: Floor/ceiling assemblies between dwelling units or between a dwelling unit and a public service area within the structure shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492.

Allwood ALL-IN-ONE premium floor underlayment is designed for both moisture and sound control. The IIC and STC ratings are both 73, surpassing the National Building Code for multi-family dwellings.

Installation

- Leave a small gap between the floor and moldings as well as the floor and the wall.
- When using nail/staple down installation, the sound insulation material should be installed at a location where the nails/staples will not penetrate into it.

Appendix E. Moisture Testing and Vapor Retarders

Moisture Testing

Flooring Installers must know the MC of the wood flooring, as well as the subfloor. Refer to NWFA Installation Guidelines for Moisture Testing for Wood Flooring, Wood Subfloors and Concrete Slabs.

Acceptable Vapor Retarders

The 2012 IBC defines three classes of vapor retarders:

- Class I 0.1 perm or less.
- Class II 0.1 - 1.0 perm.
- Class III 1.0 - 10 perm.

Over Wood Subfloors

- Acceptable vapor retarder is a vapor resistant material, membrane or covering with a perm .7 to 10. Install a vapor retarder over wood subfloors prior to installing nail/staple down solid flooring. Overlap seams a minimum of 4 inches.
- Some examples of acceptable vapor retarders over wood subfloors include:
  - An asphalt laminated paper.
  - Asphalt-saturated kraft paper or #15 or #30 felt paper.
  - See NWFA Installation Guideline for more details.
- Do not use an impermeable vapor retarder material with a perm rating of .7 or less, as it may trap moisture on or in the wood subfloor.

Over Concrete

The NWFA recommends an “impermeable” vapor retarder with a perm rating of less than or equal to .15.
Acceptable vapor retarders over concrete include

- Allwood All-in-One Premium Floor Underlayment with a perm less than 0.1.
- A minimum 6 mil construction grade polyethylene film or other impermeable material with a perm of .15 or less.
- See NWFA Installation Guidelines for other types of acceptable vapor retarders over concrete.