

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.

Tools & Accessories Needed

BEFORE YOU START



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

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 – 1/2 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.

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.

Estimate Dimensional Movement

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

Sound Control

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

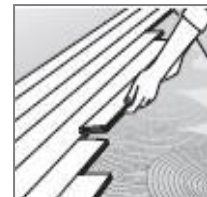
Moisture Testing and Vapor Retarders

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

Solid Flooring Installation

START INSTALLATION

- Staple/Nail-Down Installation
- Glue-Down Installation



Depending on the sub-floor and personal preference, solid flooring can be installed using nail/staple-down or glue-down methods. Allwood solid flooring includes all the wood species that Allwood offers in the Solid Collection, and solid bamboo in Classic and Strand Collections. Solid flooring can be installed on or above grade level.

Staple/Nail-Down Method

STEP 1: Establish a Starting Point

- Installation parallel to the longest wall is recommended for best visual effects, however, the floor should be installed perpendicular to the flooring joists, or perpendicular to the solid subfloor boards. Find appropriate subfloor from "Subfloor Type" section in this instruction manual.
- With frame construction, mark location of joists on perimeter walls so that starting runs and finishing runs, which require face nailing, can be nailed into joists.
- When $\frac{3}{4}$ " solid flooring is laid parallel with the floor joists, or when solid flooring is less than $\frac{3}{4}$ " thickness, add a layer of minimum $\frac{1}{2}$ " (15/32") CD Exposure 1 (CDX) plywood underlayment to the existing subfloor.
- Pre-plan the floor by counting the number of planks (in width) that it will take to complete the floor. Avoid finishing out with a rip narrower than 2". Plan to start the first row with a partial board, ripping it to the necessary width to avoid a narrow rip on the final wall.

STEP 2: Installing Vapor Retarder

- Before installing the floor, use a vapor retarder. Some examples of acceptable vapor retarders over wood subfloors include:
 - An asphalt laminated paper meeting UU-B-790a, Grade B, Type I, Style 1a.
 - Asphalt-saturated kraft paper or #15 or #30 felt that meets ASTM Standard D4869 or UU-B-790, Grade D.
 - Cover the subfloor with a good grade of #2 vapor retarders. Extend the felt/building paper completely to the walls and fasten the felt to the subfloor.

STEP 3: Installation of Flooring

Allwood recommends a Center Line Out installation, especially when spacers are needed. Start in the middle of the room and install out towards the walls. Wall Line Layout is also acceptable.

Center Line Layout

- Find the center of the room, measuring off the two longest walls, and snap a line down the center of the room.
- Install a starter board on the line. Fasten the starter board to the floor using wood screws.
- Nail the first row of wood flooring against the starter board, being careful not to move the starter board when nailing. The groove of the flooring should be against the starter board.
- Use a blind nailer to install the remaining rows of wood flooring.
- After installing in one direction, remove the starter board and begin installing rows in the opposite direction.
- Install a spline or a slip tongue in the groove of the board that was against the straightedge. Put wood flooring adhesive down the entire length of the groove before installing the splines.
- Install the spline using a blind nailer. To keep the spline in alignment for the next flooring board, use a scrap piece of wood flooring to run along the length of the spline as you nail.

Wall Line Layout

- In at least two places 12"-16" from the corner, measure out equal distance from the starting wall and snap a chalk line. The chalk should be of a bright color so that it is visible through vapor retarder. If a partial, ripped board is required (as above) it can be installed after the balance of the flooring has been completed.
- Adjust the starting line to allow for the width of the board plus $\frac{3}{4}$ " for expansion. As a general rule, a $\frac{3}{4}$ " expansion space must be left around the perimeter and at all vertical obstructions.
- Ascertain that the wall is straight. If it is not, scribe the first row to allow for irregularities.
- Lay one row of plank along the entire length of the working line. The groove should be facing the starting wall.
- Top-nail and blind-nail the first row (hand-nail if necessary). Solid strand flooring may need to be pre-drilled before nailing due to its extreme hardness. Each succeeding row should be blind-nailed wherever possible.
 - Typical: Blind-nail through the tongue using $1\frac{1}{2}$ " to 2" fasteners. Use $1\frac{1}{2}$ " fasteners with $\frac{3}{4}$ " plywood subfloor direct to concrete slab. Face-nail boards where needed using 6d-8d casing or finish nails.
 - Typical: Space blind-nailing every 6"-8"; space face-nailing every 10"-12".

- Add each additional row of flooring. Distribute lengths, avoiding “H” patterns and other discernible patterns in adjacent runs. Stagger end joints of boards row to row a minimum of 6 inches.
- During installation of flooring pieces, push or gently tap boards flush to the previous row. Tap against the tongue; tapping the groove may damage the edge. To prevent damage to the finish, avoid tapping the face of the board with a rubber mallet. Note that Allwood engineered floor collections are purposely designed with tight tongue and groove connections for better hold-in-place during installation.
- At the finishing wall and other obstructions, it may be necessary to blind-nail by hand until top nailing is required.
- To minimize expansion on floors wider than 20 feet, more or less spacing between rows may be needed, depending on the flooring MC at the time of installation, the geographical area, interior climate control and time of the year.
- Where spacing is required: Use a washer or removable spacer to leave additional space every few rows and/or start in center of room and work out to both sides. Do not use spacers that may cause damage on the floor products.
- Blind-nail, face-nail or use wood floor adhesive, as necessary, to complete the final rows.

Glue-Down Method

See **Glue-Down Method** under **Engineered Flooring Installation** section in this manual.

Solid Flooring Installation Addendum

Installation

- Do NOT install Allwood solid flooring if the moisture content (MC) of the wood and the MC of the subfloor have more than 2% difference. The Flooring and the Subfloor must be acclimated at normal living conditions until the MC in each are within 2%.
- If installation occurs during a heating season when the humidity of the interior is low, and the flooring is acclimated at this condition to a lower MC in the yearly EMC range:
 - Allwood recommends the use of removable spacers every few rows. Estimate the maximum expansion potential using the equation in the NWFA Installation Guideline to decide how many spacers should be used. Do not use spacers that will damage Allwood Solid Flooring
 - Allwood recommends the use of cleats over staples. Cleats do not hold as tight as staples and can allow some extra movement if needed.
- When installing solid flooring over concrete, a vapor retarder is always required over the concrete slab and below the subflooring material. A minimum 6 mil construction grade polyethylene film, with perm of .13, or other impermeable material with a perm of .15 or less is recommended.

Acclimation

- Thermal Acclimation
 - The first step in acclimation is to bring the temperature of the wood to that of its environment.
 - Thermal Acclimation can be done in original packaging.
 - With large temperature swings it is important to slowly and gradually bring the wood to living temperatures. Suggested rate is about 10°F per day. Cold wood into a warm house or hot wood into a cool house can shock and traumatize the wood causing irreversible damage. This process may take 3-5 days on average.

- Moisture Content (MC) Acclimation
 - Remove the wood from packaging, and rack out on floor or stickers to allow for proper acclimation.
 - Acclimate until the MC of the flooring has reached targeted MC, which is about 1/3 to ½ of EMC control range from the lower end, and within a 2% MC range of the subfloor. It may take days, weeks or months, depending on the target MC. Allwood solid flooring has average 7% MC ex-factory.
 - When acclimating the flooring, interior temperature and humidity must be set to occupied conditions. In most geographic locations, during most of the year, exterior conditions are either too humid or too dry. So **acclimating under such conditions is counterproductive and may cause serious damage to the flooring.**

Completing the Job

- **Clean** floor with the appropriate Cleaner. (See adhesive container for specific information)
- Re-install any transition pieces that may be needed, such as Reducer Strips, T-moldings, or Thresholds, and all bases and/or quarter round **moldings**. Nail moldings into the wall, not the floor. Inspect the floor, filling all minor gaps with the appropriate blended filler.
- For better **match** of the floorings, use Allwood trims, moldings, and stair parts, prefinished or unfinished.
- If the floor is to be **covered**, use a breathable material such as cardboard. Do not cover with plastic.
- Leave the floor Maintenance Guidelines and Warranty with the owner. Advise them of the product description and sku they purchased when filling the product registration form.
- To prevent **surface damage** avoid rolling heavy appliances and furniture on the floor. Use plywood, hardboard or appliance lifts if necessary.
- Before you move furniture onto the floor, take a moment to protect your new floor by putting **felt pads** on all furniture and accessories. For complete care and maintenance instructions, consult the product warranty.
- If the flooring was installed over a radiant heating system, when you turn the system back on bring the temperature of the system **up gradually**, in 5° increments. Never allow the surface temperature of the floor to exceed **82°F** (28°C) and avoid dramatic temperature changes; always adjust the system gradually in 5° increments. It is recommended that a dedicated quick recovery thermostat be installed to allow the temperature of the radiant heating system to be accurately controlled

References:

This Allwood Installation Instruction Manual is created based on the National Wood Flooring Association (NWFA) Installation Guidelines (updated Sept, 2021). 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 $\frac{1}{4}$ " in 10 feet or $\frac{3}{16}$ " in 6 feet radius.
- For glue-down installations and installations using mechanical fasteners of less than $1\frac{1}{2}$ ", the subfloor should be flat to within $\frac{3}{16}$ " in 10 feet or $\frac{1}{8}$ " 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 ($\frac{1}{8}$ ") 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 $\frac{5}{8}$ " ($\frac{19}{32}$ ", 15.1mm) CD Exposure 1 Plywood subfloor panels (CD Exposure 1) or $\frac{23}{32}$ 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 $\frac{3}{4}$ " ($\frac{23}{32}$ ", 18.3mm) T&G CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4' x 8' sheets, glued and mechanically fastened, or minimum $\frac{3}{4}$ " ($\frac{23}{32}$ ", 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 $\frac{7}{8}$ " 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 $\frac{3}{4}$ " ($\frac{23}{32}$ ", 18.3mm) CD Exposure 1 Plywood subfloor panels (CDX), 4' x 8' sheets or nominal $\frac{3}{4}$ " ($\frac{23}{32}$ ", 18.3mm) OSB Exposure 1 subfloor panels, 4' x 8' sheets. The second layer should consist of nominal $\frac{1}{2}$ " ($\frac{15}{32}$ ", 11.9mm) CD Exposure 1 plywood subfloor panels, (Exposure 1) 4' x 8' sheets. The $\frac{1}{2}$ " plywood should be offset by $\frac{1}{2}$ " panels in each direction to the existing subflooring. The panels may also be laid on a diagonal or perpendicular, with $\frac{1}{8}$ " 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 $\frac{1}{8}$ " 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: 3/4" x 5 1/2" (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.
- 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 ¼" 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 ¼" 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 diagonally to direction of flooring.
 - Panels staggered every 2', and spaced 1/8" between ends, with ¼" 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.

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. A humidistat or hygostat 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 1/4" 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 – 1/2 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.

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 2021 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

- 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.