

Section III

Installation Guidelines & Methods

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Chapter 7

Parquet Installation

Part I

Acceptable Jobsite Conditions and Jobsite Checklist

- A. See Chapter 1, Jobsite Conditions.

Part II

Acclimation Guidelines

- A. See Chapter 2, Acclimation and Conditioning of Wood Flooring.

Part III

Appropriate Grade Levels

- A. Solid parquet wood floors can be installed successfully above grade level or on grade, but are not recommended for installation below grade.
- B. The entire flooring level is considered to be below grade where soil is present along any perimeter wall and is more than 3" above the installed wood flooring level. Ground should be sloped away from the house for proper drainage. (Follow local building codes.)

Part IV

Subfloors – Wood Joist Systems

- A. See Chapter 4, Wood Subfloor Guidelines.
- B. Parquet cannot be installed directly to solid board subfloors. For parquet installations, board subfloors must have additional underlayment.

Part V

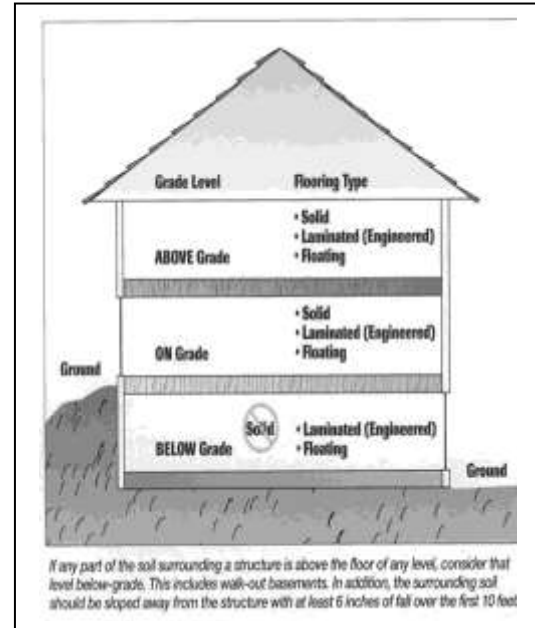
Subfloors – Concrete Slab

- A. See Chapters 5, Concrete Subfloor Guidelines, and Chapter 6, Installing a Subfloor Over Concrete.

Part VI

Parquet Installation Methods

- A. Follow manufacturer's recommendations.
1. The styles and types of block and parquet flooring, as well as the recommended procedures for application, vary somewhat among manufacturers. Detailed installation instructions are usually provided with the flooring or are available from the manufacturer or distributor.
- B. Test wood subflooring for moisture according to moisture testing procedures. (See Chapter 3, Moisture Guideline and Vapor Retarders.)
- C. Test concrete for moisture according to moisture testing procedures in Chapter 3, Moisture Guideline and Vapor Retarders. Moisture indicators should be within the adhesive and flooring manufacturers' specifications.
- D. A minimum expansion space of 1/2" must be left around the perimeter and all vertical obstructions.
- E. Some 3/4" parquet is appropriate for nail-down installation, as long as the pattern continues to have an exposed side tongue in which to nail.
- F. Lay blocks and/or individual pieces of parquet in adhesive.
- G. Use the wood manufacturer's approved adhesive. Follow the spread rate, trowel size and installation procedure as recommended by the adhesive manufacturer.



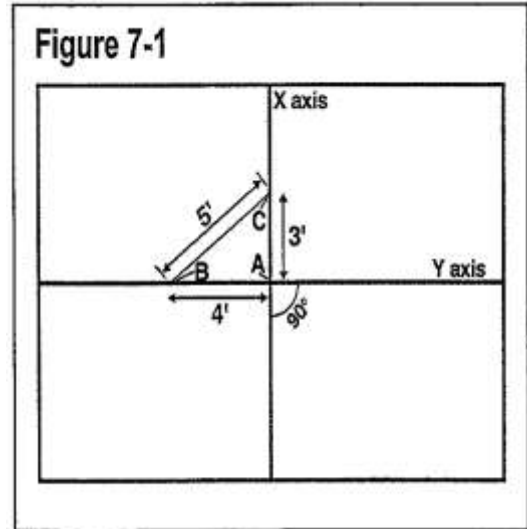
Part VII

Parquet Layouts

A. Square Layout from the Center of the Room (See Figure 7-1)

Note: For instructions on using the trammel point method to square a room and find the center point, see Appendix G, Trammel Point Method.

1. Start by snapping a chalk line through the center of the room (line Y). The next line (X) must be exactly 90 degrees to line Y to form a perfect square corner. To ensure this angle, do the following:
2. From the center point (A) of line Y, measure 4 feet along line Y and mark that point (B).
3. From the same center point, measure 3 feet in the general direction of where line X will be and scribe an arc.
4. Return to the original 4-foot mark on line Y and measure 5 feet, scribing an arc that crosses (point C) the 3-foot arc you made in the previous step.
5. Verify all measurements before proceeding.
6. If correct, snap a chalk line through the conjunction of the two arcs at point C and the center point of line Y. This will be line X, at an exact 90-degree angle to line Y.

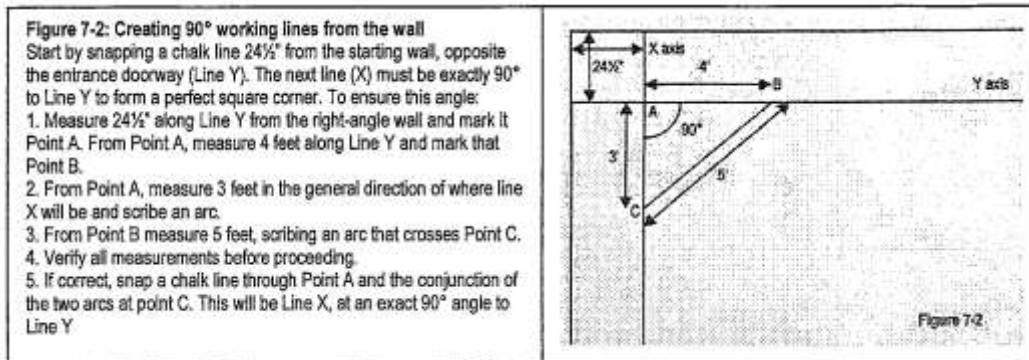


B. Square Layout from the Wall (See Figure 7-2)

Square edge block or basket weave pattern can be laid wall to wall without centering the tiles on the room. The results will not be balanced but the tiles have no edge treatment to delineate the difference in tile sizes when unbalanced. More intricate patterns generally require the flooring to be centered.

1. Wall Line Layout

- a. If the room dimensions allow, in at least two places from the corner, measure out and establish a chalk line parallel to and $24\frac{1}{2}$ " (62cm) away from the starting wall opposite the entrance doorway. The $\frac{1}{2}$ " (12.7 mm) is for expansion space.



- b. Snap a second chalk line 90 degrees to the first chalk line using the method shown in Figure 7-2, $24\frac{1}{2}$ " (62cm) away from the right angle wall. The $\frac{1}{2}$ " is for expansion space.
- c. Make any necessary adjustments to allow for walls out of square before proceeding.

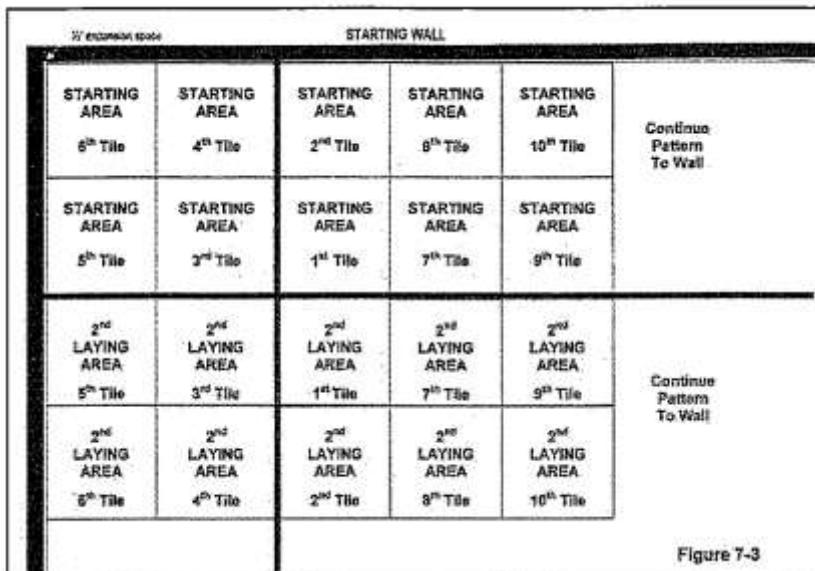
C. Installation Using Wall Layout (See Figure 7-3)

1. Spread the Adhesive

- a. After both chalk lines (at 90 degrees to each other and $24\frac{1}{2}$ " (62cm) from the wall) have been snapped, start spreading the adhesive in the $24\frac{1}{2}$ " (62cm) wide area next to the starting wall.
- b. Continue spreading the adhesive along the entire length of the starting wall. Be careful not to spread adhesive beyond the $24\frac{1}{2}$ " (62cm) chalk line.

2. Immediately lay the floor tiles on the newly spread adhesive.

3. Do not lay the floor tiles on dry adhesive. If the adhesive becomes too dry, scrape up the old adhesive and spread more.
4. Important: Stand or kneel on the subfloor during the installation to avoid shifting the tiles.
5. Proper placement of the first floor tile is the key to the entire installation. Carefully place a 12" x 12" (30 x 30 cm) parquet tile at the intersection of the two chalk lines. (See Figure 7-3.) Do not use the edge of the tongue for aligning the tile on the chalk lines.

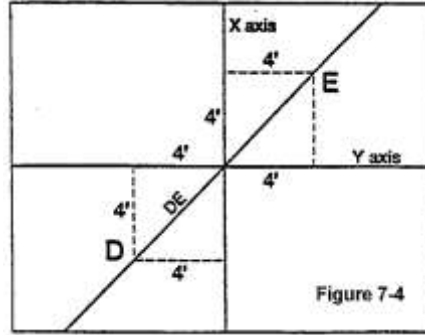


When the starting area has been completed, including cutting to the wall, proceed to the second laying area, then to laying areas 3, 4, 5, etc., repeating the installation procedure of the starting area.

6. Lay the second floor tile ahead of the first tile to fit ½" (12.7 mm) from the starting wall. Gently lock in the tongue and groove between the first and second floor tiles.
7. Recheck to be sure both floor tiles are properly lined up with the chalk line. This is to ensure a square starting area.
8. Continue laying the balance of the 12' x 12' (30.48cm) floor tiles along the starting wall area. Put each floor tile in place and gently push the floor tiles together to interlock the tongue and groove. Align each floor tile squarely.
9. Do not push the floor tiles too strenuously as this could cause the first and second floor tiles to move. Simply realign them and proceed with the installation. Avoid hammering or forcing the floor tiles together as this may destroy the squareness of the floor tile.
10. After laying the floor tiles across the first 24½" (30.48 cm) starting area, trim the last floor tiles as needed to obtain the proper ½" (12.7 mm) expansion space next to the walls. Use a small band or saber saw for final trimming. Firmly secure each floor tile when cutting with a saber saw.
11. Complete the installation.
 - a. When the starting area has been completed, including cutting to the wall, proceed to the second laying area. (See Figures 7-3.)
 - b. Cut the last floor tiles to allow a ½" (12.7 mm) expansion space from the end wall.
 - c. Proceed by laying areas 3, 4, 5, etc., repeating the installation procedure of the starting area. Trim out each laying area before proceeding to the next area.
 - d. Maintain the ½" (12.7 mm) expansion space around the perimeter of the room and around all fixed objects.
 - e. Allow a minimum of 24 hours drying time before moving furniture or walking on the newly laid parquet floor.

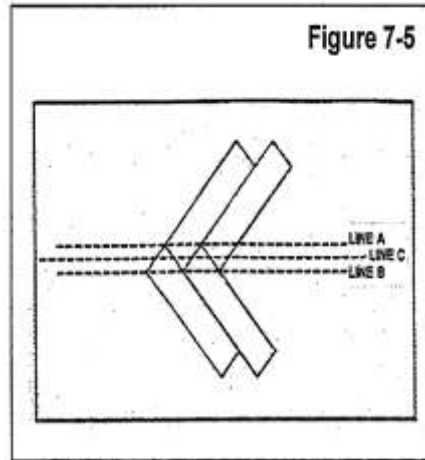
D. Diagonal Layout (See Figure 7-4)

1. Establish a 45-degree working line.
2. From the center point, measure 4 feet down in each direction on lines X and Y, which you have already determined by the method described previously.
3. From each of these points, measure 4 feet and scribe an arc. The conjunction of these arcs creates points D and E.
4. Snap a chalk line between points D and E, and the center point. This line represents a 45-degree angle.



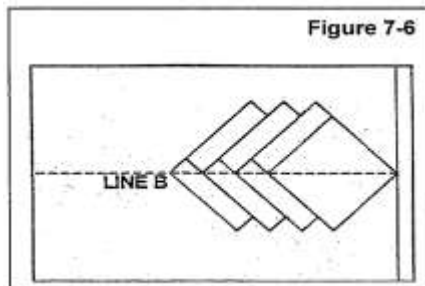
E. Herringbone Layout

1. Use reference lines throughout the area that is being installed.
2. The multiple of the width should equal the exact length of the piece. If the width of the product varies, this will cause separations at the end of the herringbone pieces.
3. Herringbone parquet can be laid out parallel or at a 45-degree angle to the room. Regardless of direction, Herringbone parquet will require a centerline and two working lines (See Figure 7-5).
4. Begin by laying out a few alternating slats.
5. Snap lines A & B through the corners of the alternating slats (See Figure 7-5).
6. Measure the distance from Line A to Line B. Line C should be $\frac{1}{2}$ that distance and run parallel to Lines A & B. The centerline of the room and the center of the pattern is represented by Line C.



F. Herringbone Installation

1. To begin installation on working Line B (See Figure 7-6), cut a square piece of plywood the size of the herringbone pattern. For example, if the herringbone pattern is 3" x 12", cut a 12" x 12" square of plywood.
2. Fasten the piece of plywood at your starting point on Line B, with one corner of the square pointing in the direction of the pattern.



Chapter 8

Engineered Wood Flooring Installation

Part I

Acceptable Jobsite Conditions and Jobsite Checklist

- A. See Chapter 1, Jobsite Conditions.

Part II

Acclimation Guidelines

- A. See Chapter 2, Acclimation and Conditioning of Wood Flooring.

Part III

Appropriate Grade Levels

- A. Engineered wood floors can be installed successfully on, above or below grade level. Engineered wood floors can be installed directly to a concrete or wood subfloor.
- B. The entire flooring level is considered to be below grade where soil is present along any perimeter wall and is more than 3" above the installed wood flooring level. Ground should be sloped away from the house for proper drainage. (Check local building codes. Local building codes prevail. Follow local building codes.)

Part IV

Subfloors – Wood Joist Systems

- A. See Chapter 4, Wood Subfloor Guidelines.

Part V

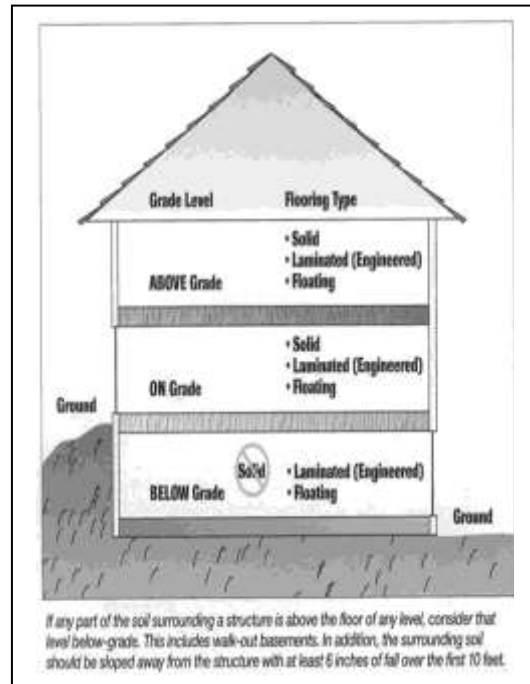
Subfloors – Concrete Slab

- A. See Chapters 5, Concrete Subfloor Guidelines, and Chapter 6, Installing a Subfloor Over Concrete.

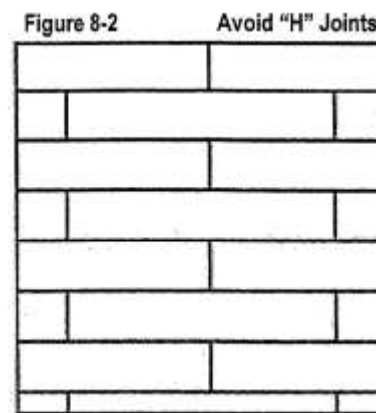
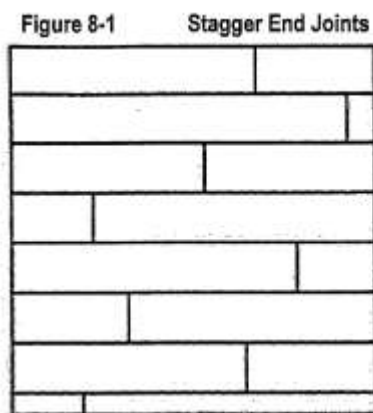
Part VI

Engineered Flooring Installation Methods

- A. Engineered wood flooring can be installed directly to screeds, provided the engineered flooring is a minimum of $\frac{3}{4}$ " thick. For engineered flooring less than $\frac{3}{4}$ " thick, the screed system must be overlaid with proper subflooring. See Appendix I, Installation Over Screeds.
- B. Note on random-width plank.
1. Random-width plank is laid out with alternating courses varying by widths. Start with the widest board, then the next width, etc., and repeat the pattern.
- C. Choose a starting wall.
1. Choose a starting wall according to the most aesthetically or architecturally important elements in the room, taking into consideration fireplaces, doors, cabinets and transitions, as well as the squareness of the room. The starting wall will often be the longest unbroken wall in the room.
- D. Glue-down engineered strip and plank.
1. There are several different ways to start the installation of glue-down engineered wood flooring. The following has proven successful. However, where instructions differ from manufacturer recommendations, manufacturer recommendations prevail.
 2. Test the substrate for moisture according to appropriate moisture testing procedures in Chapter 3, Moisture Guideline and Vapor Retarders. Excessive/elevated moisture should not be present. The subfloor should be within acceptable moisture content as per adhesive and wood manufacturer's recommendation before installing.



3. Expansion space should be left around the perimeter in accordance with the manufacturer's recommendation.
4. Snap a working line parallel to the starting wall, the width of the board, plus the tongue and recommended expansion space.
5. Install a starter board along the edge of the working line and begin installation. Alternatively, lay one row of plank in the adhesive along the length of the working line.
6. Follow manufacturer instruction for tongue and groove direction and placement.
7. Use an adhesive approved by the flooring manufacturer. Follow the installation procedure recommended by the adhesive manufacturer, which includes subfloor moisture content, spread rate, trowel size, open time, working time and flash time as necessary. Spread the adhesive as instructed up to and along the working line.
8. Distribute lengths, avoiding "H" patterns and other discernible patterns in adjacent runs. Stagger end joints of boards row to row a minimum of 6" for strip flooring, 8"-10" for 3" to 5" plank, and 10" for plank wider than 5". (See Figures 8-1 and 8-2.)



9. If recommended by the manufacturer, use tape or tensioners to maintain a tight floor.
 10. If recommended by the adhesive manufacturer, roll the floor with the proper roller.
- E. Mechanically fastened strip and plank.
1. If necessary, add a vapor retarder.
 2. Snap a working line parallel to the starting wall, allowing expansion space as specified by the manufacturer.
 3. Lay one row of plank along the entire length of the working line.
 4. Top-nail and blind-nail the first row (hand-nail if necessary), using appropriate fasteners. Denser species may require pre-drilling. Each succeeding row should be blind-nailed wherever possible.
 - a. Typical: Narrow crowned (under 3/8") 1"-1½" staples or 1"-1¼" hardwood flooring cleats designed for engineered flooring, spaced as recommended by the manufacturer.
 - b. Typical: Every 3"-4" with staples, every 4"-6" with cleats, and within 1"-2" of end joints. Use appropriate size fastener for top nailing first row, last row and any area where blind nailer will not fit.
 5. Add each additional row of flooring. Distribute lengths, avoiding "H" patterns and other discernible patterns in adjacent runs. Stagger end joints at least three times the width of the boards, as product allows.
 6. 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.
- F. Floating engineered flooring.
1. Subfloor flatness is critical to the success of a floating floor installation. (See Chapter 4, Wood Subfloor Guidelines, and Chapter 5, Concrete Subfloor Guidelines.)

2. Test the substrate for moisture according to appropriate moisture testing procedures in Chapter 3, Moisture Guideline and Vapor Retarders. Excessive/elevated moisture should not be present. The subfloor should be within acceptable moisture content as per manufacturer recommendation before installing.
3. If necessary, add vapor retarder. (See Chapter 3, Moisture Guideline and Vapor Retarders, Part III, Acceptable Vapor Retarders Over Wood Subfloors.)
4. Expansion space should be left around the perimeter or in accordance with manufacturer's recommendation.
5. Typical: Subfloors are covered with a resilient material, foam underlayment or cork. Follow manufacturer's instructions for correct materials and thickness.
6. Typical: Floating engineered flooring is edge-glued or edge-attached with a self-locking mechanism.
 - a. For edge-glued products, use a glue approved by the flooring manufacturer.
 - b. Apply glue at the spread rate to the side grooves and/or ends as recommended by the flooring manufacturer.
7. Starter boards should be aligned with the groove side and end against the starting wall. Tapping block should be used against tongue only.
8. Stagger end joints per manufacturer's recommendation.

Chapter 9

Solid Strip and Plank Flooring Installation

Part I

Acceptable Jobsite Conditions and Jobsite Checklist

- A. See Chapter 1, Jobsite Conditions.

Part II

Acclimation Guidelines

- A. See Chapter 2, Acclimation and Conditioning of Wood Flooring.

Part III

Appropriate Grade Levels

- A. Solid strip and plank wood floors can be installed successfully above grade level or on grade, but are not recommended for installation below grade.
- B. The entire flooring level is considered to be below grade where soil is present along any perimeter wall and is more than 3" above the installed wood flooring level. Ground should be sloped away from the house for proper drainage. (Follow local building codes.)

Part IV

Subfloors – Wood Joist Systems

- A. See Chapter 4, Wood Subfloor Guidelines.

Part V

Subfloors – Concrete Slab

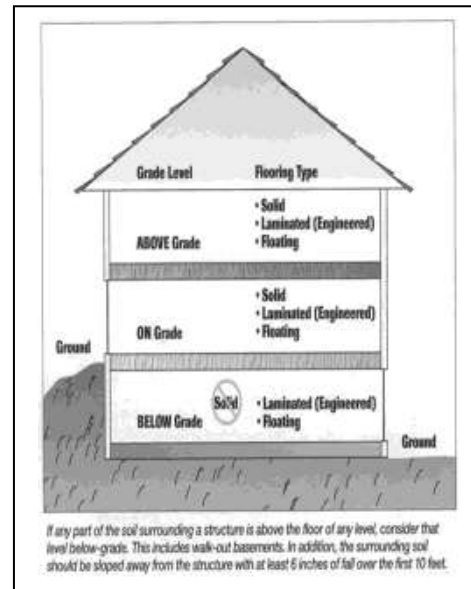
- A. See Chapter 5, Concrete Subfloor Guidelines.
- B. When installing solid strip and solid plank flooring over concrete, a vapor retarder is always required over the concrete slab and below the subflooring material. A minimum 6 mil construction grade polyethylene film, with perm of .13, or other impermeable material with a perm of .15 or less is recommended.
- C. Some manufacturers allow direct glue installation of $\frac{3}{4}$ " solid strip and solid plank flooring. In such cases, follow wood or adhesive manufacturer's recommendation.

Part VI

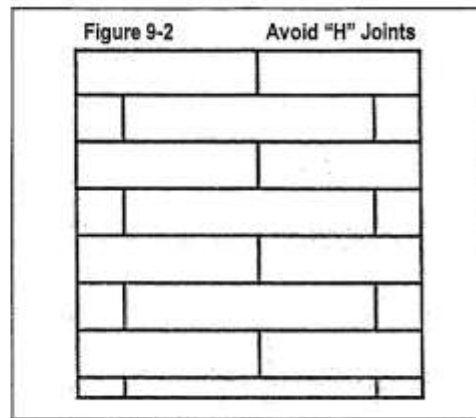
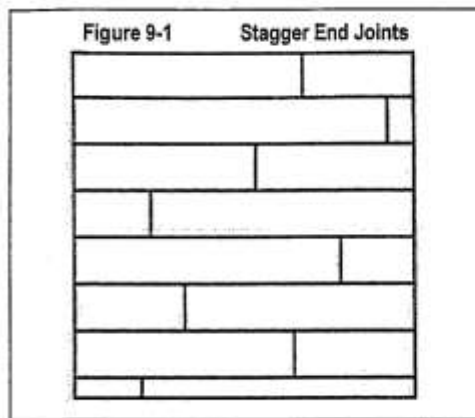
Solid Strip & Plank Installation Methods

Floor preparation: Refasten any loose areas of subfloor and clean the subfloor by sweeping, scraping, etc., as necessary. 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. Marking also locates the joists for plank flooring installation. Flooring direction: In general over single layer subfloor, wood should be installed perpendicular to the floor truss.

- A. Always follow the manufacturer's recommended installation procedure.
- B. Unfinished and factory-finished solid strip and solid plank flooring should be installed perpendicular to the joists or on a diagonal for any single layer subfloor. (Exception: Over diagonal, solid subfloor boards, install perpendicular to joists or subfloor direction.)
- C. When $\frac{3}{4}$ " solid strip and solid plank flooring is laid parallel with the floor joists, follow one of these two steps below:
 1. Add a layer of minimum $\frac{1}{2}$ " (15/32") CD Exposure 1 (CDX) plywood underlayment to the existing subfloor (as previously recommended).
 2. Or brace between truss/joists 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.



- D. Before installing wood flooring, use an approved vapor retarder. Some examples of acceptable vapor retarders over wood subfloors include:
1. An asphalt laminated paper meeting UU-B-790a, Grade B, Type I, Style 1a.
 2. Asphalt-saturated kraft paper or #15 or #30 felt that meets ASTM Standard D4869 or UU-B-790, Grade D.
 3. Cover the subfloor with a good grade of #2 vapor retarders (see Perm Rating Chart in Chapter 3) ASTM 4869, lapped 2" - 4" along the edge seams. This retards moisture movement from below. Extend the felt/building paper completely to the walls. It is necessary to fasten the felt to the subfloor.
- E. Wall Line Layout
1. Choose a starting wall according to the most aesthetically or architecturally important elements in the room, taking into consideration fireplaces, doors, cabinets and transitions, as well as the squareness of the room. The starting wall will often be the longest unbroken wall in the room.
 2. Snap a working line parallel to the starting wall, allowing $\frac{3}{4}$ " expansion space between the starting wall and the edge of the first strip or plank run.
 3. As a general rule, a $\frac{3}{4}$ " expansion space must be left around the perimeter and at all vertical obstructions.
 4. Random-width plank is laid out with alternating courses varying by widths. Start with the widest board, then the next width, etc., and repeat the pattern.
 5. Lay one row of strip or plank along the entire length of the working line.
 6. Top-nail and blind-nail the first row (hand-nail if necessary), using appropriate fasteners. Denser species may require pre-drilling. Each succeeding row should be blind-nailed with the nailing machine wherever possible. At the finishing wall and other obstructions, it may be necessary to blind-nail by hand until top nailing is required.
 7. Racking rule of thumb: Avoid H patterns. Stagger end joints of boards row to row a minimum of 6" for strip flooring, 8"-10" for 3" to 5" plank, and for plank wider than 5 inch, stagger as much as possible with minimal or no H joints. See Figures 9-1 and 9-2.



8. To minimize expansion on floors wider than 20 feet, more or less spacing between rows may be needed, depending on geographical area, interior climate control and time of the year.
9. 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 factory-finished products.
10. Nailing: 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. Fasteners should be spaced every 6"-8" on blindnailing, or every 10"-12" on face-nailing.
11. If adhesive is used with nailing, follow wood and/or adhesive manufacturer's instructions for installing plank flooring.
12. Blind-nail, face-nail or use wood floor adhesive, as necessary, to complete the final rows.

F. Center Line Layout

Note: For instructions on using the trammel point method to square a room and find the center point, see Appendix G, Trammel Point Method.

1. Find the center of the room, measuring off the two longest walls, and snap a line down the center of that room.
2. Install a starter board on the line. Fasten the starter board to the floor using wood screws.
3. 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.
4. Use a blind nailer to install the remaining rows of wood flooring. Use the nailing practices described earlier in the chapter.
5. After installing in one direction, remove the starter board and start rows going in the opposite direction.
6. 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.
7. 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.
8. Install the remaining rows in the opposite direction. Use the nailing practices described earlier in the chapter.

Coefficients of Change: How Moisture Affects Wood Flooring

At 70 Fahrenheit, a relative humidity of 25 percent gives an EMC of 5 percent, and a relative humidity of 75 percent gives an EMC of 14 percent. A 50 percent variance in relative humidity produces an EMC change of 10 percent. How that affects wood flooring depends on which species is being used. However, let's say the width variation is just 1/16" for a 2 1/4" board. That's a full inch over 16 boards in a floor. Over the width of a 10-foot wide floor, that amounts to more than three inches of total expansion or contraction. Protective coatings cannot prevent wood from gaining or losing moisture; they merely slow the process. Installers need to take those expected dimensional variations into account when installing the wood flooring.

This is a tool for the wood flooring professional to calculate perpendicular movement, but not absolute due to variable conditions. These variables need to be taken into consideration when calculating dimensional change coefficients (e.g., plain sawn dimensional change vs. rift sawn dimensional change, etc.). These figures are noninstalled boards.

The following is a simple way to determine the number that will be used to calculate dimensional change coefficient for any given species:

Examples:

Species type: (example only) Lapacho/Brazilian Walnut

Average reported shrinkage value (green to oven dry): Tangential 8.0%

Coefficient is determined by taking the tangential shrinkage and dividing it by the fiber saturation point. (To find the fiber saturation point, google the species.)

Answer: $.8/20 = .004$ coefficient

A red oak (change coefficient = .00369) (see page 6 of NWFA Technical Publication A100, Water & Wood) board 5 inches wide experiences a moisture content change from 6 to 9 percent – a change of 3 percentage points.

Calculations: $3" \times .00369 = .01107 \times 5 = .055$ inches

In actual practice, however, change would be diminished in a complete floor, as the boards' proximity to each other tends to restrain movement.

Chapter 10

Installation Over Existing Floors

Part I

Existing Floor Requirements

- A. Always follow the manufacturer's recommendations for installation over existing flooring.
- B. Glue-down parquet applications that require the use of PVA adhesives are not recommended over existing sheet vinyl or vinyl and cork tile flooring unless an underlayment is put down first. Underlayment should be in accordance with adhesive and/or flooring manufacturer's recommendations.
- C. Particleboard is not generally an acceptable underlayment, because it lacks stability. Some manufacturers approve particleboard as an acceptable underlayment, as they do not warrant against subfloor movement. In such cases, follow manufacturer's recommendation.
- D. Other types of adhesives may require the use of a primer or vinyl blocker when installing over sheet vinyl or vinyl and cork tile flooring. Follow adhesive manufacturer's recommendations.
- E. Nail-down applications may be successful over existing sheet vinyl or vinyl tile if fastener penetration is not significantly diminished and the subfloor meets minimum requirements. Fasteners must penetrate a proper subfloor by at least 5/8".
- F. Wood flooring can be installed over existing ceramic tile, terrazzo, or marble with proper underlayment or adhesives only on manufacturer's recommendation.
- G. Installing wood flooring over an existing wood floor.
Caution: Do not sand any surfaces containing lead based finishes/paints or asbestos. Check applicable local and federal EPA and OSHA regulations. For buildings built in 1978 and earlier, contact the EPA for lead based testing prior to any sanding (www.epa.gov).
 - 1. If safe to do so (see caution above), sand off old finish and or high spots and prep to clean, dry, sound and flat. Repair, renailed or replace loose flooring products as needed.
 - 2. Over an existing glue-down floor, glue direct to the existing floor. Or, if the thickness of the floor will allow it, staple to the existing floor. Check with the flooring manufacturer for recommendations.
 - 3. When installing new wood flooring parallel to an existing solid nail-down floor, add a minimum of 3/8" plywood underlayment over the existing floor to increase stability. Check with the flooring manufacturer for recommendations.
 - 4. When installing new wood flooring at a 45-degree to 90-degree angle to an existing solid nail-down floor, additional underlayment may not be required.