

INSTALLATION METHODS:

Glue-Down

Many types of floors can be glued down in many different situations. No matter the specific job requirements, there are several items that need to be addressed and followed during each installation. When available, the flooring and adhesive manufacturer's instructions should always be followed. Follow the adhesive manufacturer installation instructions specifically for substrate preparation and trowel selection. Where manufacturer instructions are unavailable, lack information, or they reference NWFA Guidelines, use the following information.

PART I

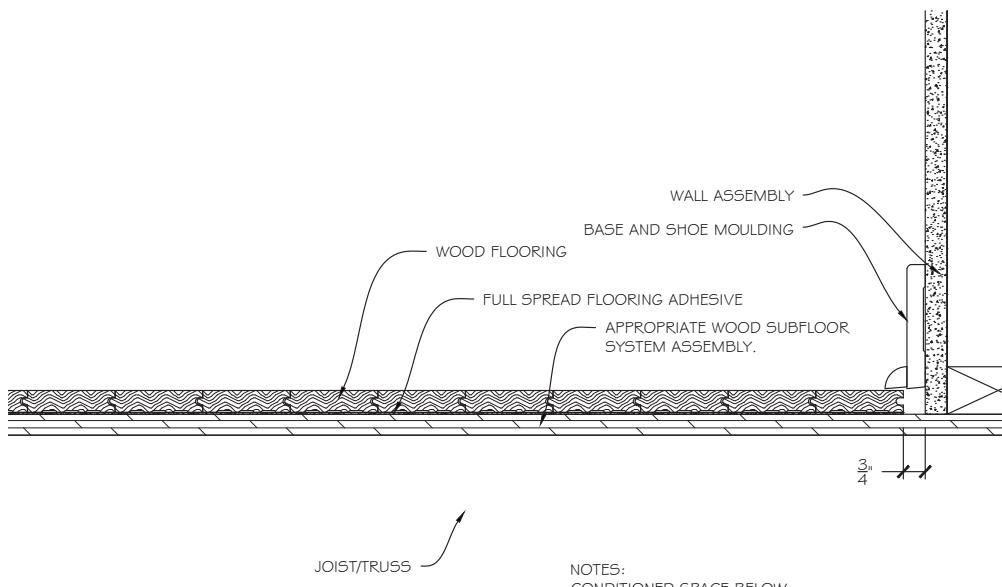
Substrate Requirements

Wood flooring may be glued down over many substrates, as long as they meet the minimum requirements as detailed in the applicable chapter. Inspect the substrate to ensure it meets all requirements for the flooring being installed.

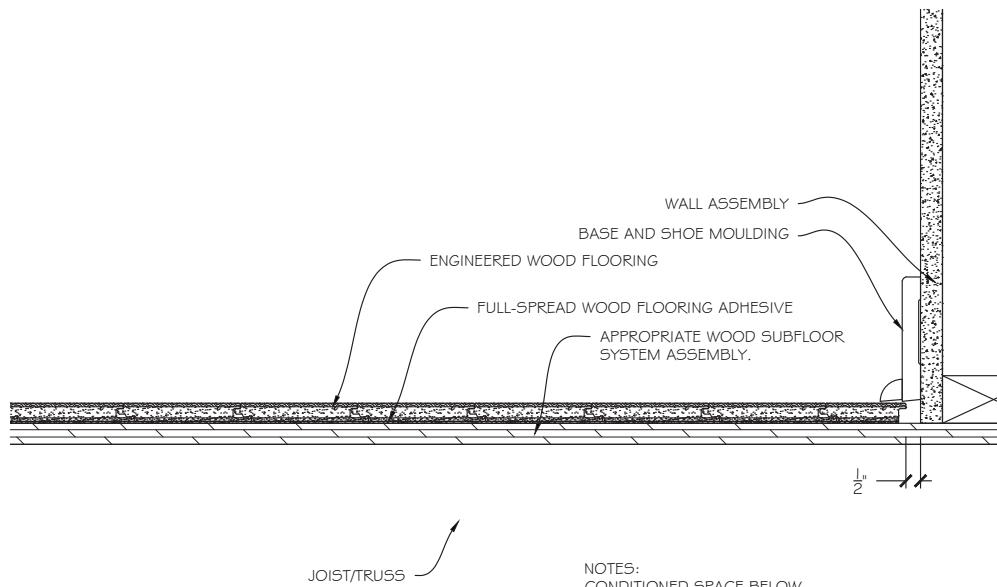
- A. Wood Subfloors (refer to the Wood Subfloors chapter for more detailed information).
 1. Inspect the wood subfloor to ensure it meets all flooring and adhesive manufacturer requirements.
 2. Test the wood subfloor material for compatibility with the adhesive being used. (Some types of wood flooring adhesives do not adhere to some high-performance OSB panels.)
 3. Check that the type and integrity of the wood subfloor is appropriate for the wood floor installation. This includes subfloor thickness and joist/floor truss spacing requirements, maximum vertical deflection requirements, and that it is sound and free from squeaks and noises.

4. Flatness: The standard for flatness with glue-down installation methods on a wood subfloor is 3/16" in 10', or 1/8" in 6'.
5. When testing for moisture, both the wood flooring and the wood subfloor should be evaluated and documented (refer to the Moisture Testing Wood chapter for testing information).
 - a. **IMPORTANT:** Never install a wood floor over a known moisture condition. A known moisture condition is one that you are aware of, and could pose future damage to the flooring, the building, or the occupants. It is compulsory practice to always test for moisture regardless of conditions so that any unknown conditions can become known conditions, which then can be handled appropriately. If subfloor moisture becomes a problem after installation, pre-installation moisture testing and documentation will provide a moisture baseline at the time of installation.
6. All solid and engineered wood flooring being glued down over a wood subfloor should be installed perpendicular to, or on a diagonal to, the joist/floor truss direction for any single-layer subfloor.

FULL-SPREAD GLUE-DOWN SOLID WOOD FLOORS OVER WOOD SUBSTRATE



FULL-SPREAD GLUE-DOWN ENGINEERED WOOD FLOOR OVER WOOD SUBSTRATE



- B. Concrete subfloors (refer to the Concrete Subfloors chapter for more-detailed information).
 - 1. Inspect the concrete subfloor to ensure it meets all adhesive and flooring manufacturer requirements.
 - 2. Address all construction joints on the jobsite. Wood flooring should not bridge these types of joints without allowing for a breaking point. Transitions and/or expansion space should be built into the wood flooring system to avoid potential wood floor damage at these locations in case of future movement.
 - 3. If any subfloor toppings such as self-levelers, skim-coatings, patches, trowelable underlays, or floor-fills exist, ensure any sealers or adhesive products are compatible with these toppings.
 - 4. Removal of any contaminants that may interfere with the adhesive system is required.
 - 5. Concrete surface profile (CSP): For concrete slabs, the concrete surface profile should be evaluated to ensure it meets the adhesive manufacturer requirements.
 - 6. Porosity: Nonporous substrates may need to be prepared to an adequate CSP. Refer to the adhesive manufacturer for more detail. Porous substrates may require the use of densifiers/hardeners (compatible with the adhesive system being used).
 - 7. Flatness: The standard for flatness for a concrete subfloor with glue-down installation methods is 3/16" in 10' or 1/8" in 6'.
 - 8. Moisture test the concrete subfloor in relation to the flooring being used. Refer to the Moisture Testing chapter for more information. When testing for moisture, both the wood flooring and the concrete subfloor should be evaluated.
 - a. Concrete slabs with a calcium chloride reading of greater than 3 lbs/1,000 sf/ 24 hr are strongly recommended to wait for further drying of the slab, or install/ apply a minimum Class I impermeable vapor retarder over the slab according to the adhesive manufacturer's instructions, prior to installation.
- b. Concrete slabs with an in-situ RH reading of greater than 80% are strongly recommended to wait for further drying of the slab, or install/apply a Class I impermeable vapor retarder according to the adhesive manufacturer's instructions, prior to installation.
- c. Always follow the adhesive and the flooring manufacturer's instructions for moisture test methods, limitations, and acceptable control of moisture. The results will help you decide which type of moisture control system will be necessary for the job.
- C. Solid board subfloors (refer to the Wood Subfloors chapter for more detailed information).
 - 1. Unless otherwise directed by the flooring and adhesive manufacturer, do not use the glue-down installation method as the only installation method over solid board subflooring.
 - 2. Minimum 19/32" subfloor panels should be installed as an overlay to achieve a suitable substrate.
- D. Screeds/sleepers (refer to the Screeds/Sleepers chapter for more detailed information).
 - 1. Full-spread glue-down and nail-assisted glue-down installation methods are appropriate over properly prepared screeds/ sleepers embedded in concrete, or when screeds/sleepers have been overlaid with the appropriate wood panel subfloor.
- E. Radiant heat (refer to the Radiant Heat chapter for more detailed information).
 - 1. Confirm the adhesive system being used is compatible with the radiant heating system.
 - 2. Reduce or turn off heat during installation of the flooring to avoid loss of open/working time, premature drying, and skinning-over of the adhesive. Check with the adhesive manufacturer for minimum/maximum subfloor temperature limitations during the installation.

PART II

Adhesives

Adhesive selection is an important step in a glue-down installation.

- A. When applicable, follow the flooring manufacturer recommendations for which adhesives to use to install the flooring.
- B. Follow the adhesive manufacturer's instructions for proper use of the adhesive.
- C. Characteristics of each adhesive, which affect application methods, include flash-time, working-time, and adjustability-time.
- D. All wood flooring adhesives must be elastomeric, which means they remain flexible and maintain their bond when there is movement in the installed flooring system.
- E. Allow the adhesive to reach room temperature before using, unless otherwise directed by the adhesive manufacturer.
- F. There are several types of adhesives used to install wood floors.
 1. Acrylic adhesives have great tack development, ease of clean-up, and are non-flammable. Acrylic adhesives contain water, which can cause some types of wood flooring to swell or become distorted. They also have limited resistance to alkalinity and slab moisture.
 2. Solvent adhesives are easy-to-apply and easy-to-clean, but are highly flammable and are odorous. For this reason, it is important to extinguish all pilot lights before using solvent adhesives. Check local restrictions for potential constraints for shipping and storing solvent adhesives.
 3. Urethane adhesives are commonly used for wood flooring installations today. They have minimal odor, and are nonflammable. This type of adhesive is moisture-resistant and alkali-resistant, but is more-difficult to clean off of the finished wood surface.
 4. Modified polymers or silane-modified polymer adhesives are solvent-free and isocyanate-free adhesives. They are easy-to-clean and have low VOCs. These adhesives are typically capable of controlling moisture in concrete when applied in a specific, manufacturer-specified method.

5. Multi-functional adhesives: These products save time by eliminating multiple steps in the process, ultimately reducing overall costs. Each product has multiple functions, which may include crack bridging, moisture control, sound control, and mold/mildew resistance. These products are often marketed as two-in-ones, three-in-ones, four-in-ones, etc.

PART III

Trowel Selection



- A. Trowel size dictates the square footage coverage of the adhesive.

B. The trowel selection is dictated by the adhesive manufacturer. Application method may include the angle at which the trowel is used to apply adhesive, or the pattern in which the adhesive is applied to the substrate.

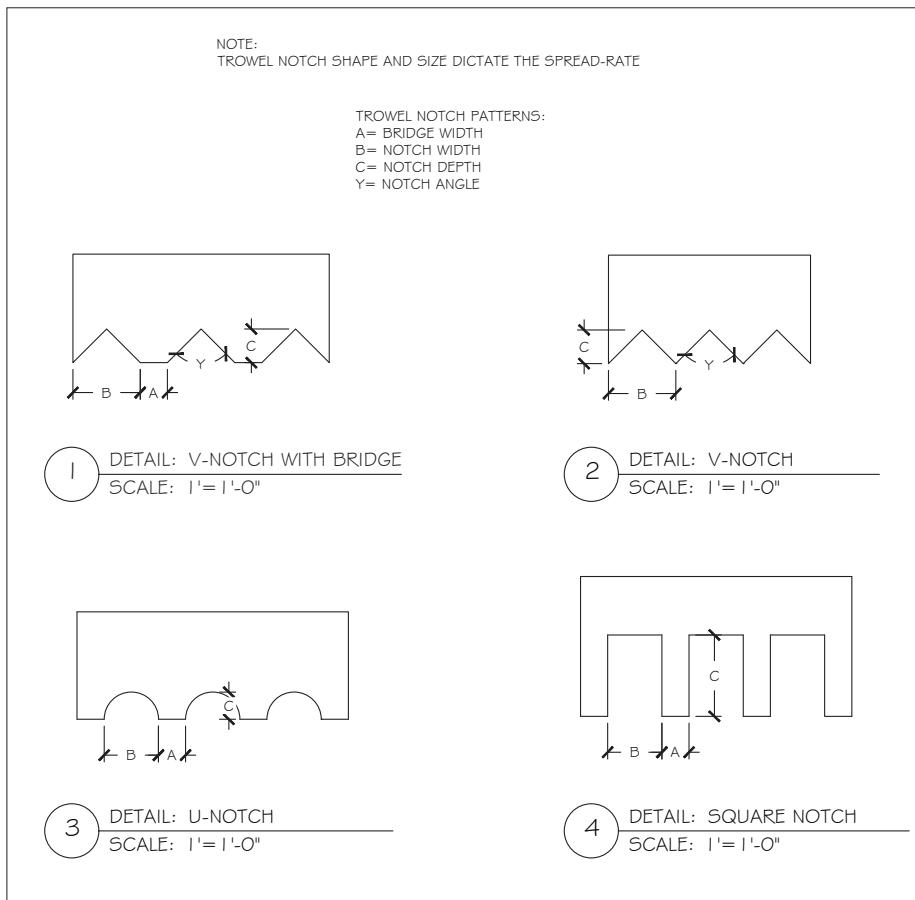


- C. It is typically required to occasionally pull boards to check for coverage and adequate adhesive transfer from the substrate to the back of the board. Unless otherwise suggested by the adhesive manufacturer, adhesive coverage should be as follows:

1. For moisture control, 100% substrate coverage and adhesive transfer is normally required for solid wood flooring product, >95% substrate coverage and adhesive transfer is required for all other wood flooring.
2. For bonding only, check coverage to ensure there is a minimum of 80% substrate coverage and adhesive transfer for engineered, and >95% for all solid wood flooring.

D. Do not use old or worn-down trowels, as the notches wear down with normal use, consequently decreasing the flow rate of the adhesive.

E. Depending on the application and product being used, the profile of the trowel will be designated for a very specific purpose. Some of the qualities that designate a trowel include the shape and dimensional specifications of the trowel:



PART IV

Glue-Down Installation

- A. Solid and engineered strip, plank, parquet, or end-grain wood flooring may be glued down.
- B. Where possible and practical, begin the installation at a point opposite of the point of egress in order to minimize walking across a newly glued-down installation. Wall-layout option is the most appropriate for glue-down installations. Refer to the Layout chapter for more-detailed information.
- C. Undercut door casings and jambs. Remove any existing base, shoe-mold, or doorway thresholds. These items can be replaced after installation.
- D. Snap a working line parallel to the starting wall, accounting for necessary expansion space.

E. Expansion space

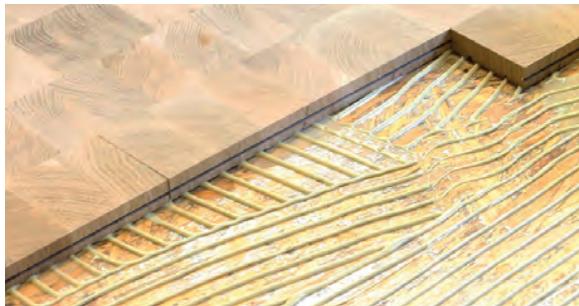
1. Maintain proper expansion space based on the material being installed at all vertical obstructions. Unless otherwise directed by the flooring manufacturer, expansion space left between the flooring and vertical obstructions is generally equal to the thickness of the material being installed.
2. To minimize expansion on floor spans wider than 20 feet, spacing between rows (within the flooring system) may be needed, depending on the wood species being installed, climate zone, interior climate controls, and the time of year.
 - a. Expansion may be built into the solid wood floor using the dimensional change coefficient (DCC) of the species being installed (refer to Moisture and Wood technical publication no. A100).

- b. Determine the DCC of the species being installed. Multiply the DCC by the width of the material being installed. Then determine approximately how much you expect the flooring to change moisture content (MC) from one season to the next, and multiply this change in MC by the product of the width and DCC. This will give you an approximation of how much each plank of flooring could shrink/swell from season to season. Use this information to determine approximate internal expansion spacing necessary for the long-term performance of the wood floor.
- c. Example: Red Oak DCC = .00369. A 5" solid red oak plank that experiences a 4% change in moisture content, may shrink or swell tangentially approximately .0738". $.00369 \times 5" = .01845 \times 4\% \text{ change} = .0738"$ of change in dimension.
- 3. Where additional internal spacing is required with some solid wood floors, use washers, edge trimmer spline, or other removable spacers to leave expansion space within the flooring system. The end-user must be made aware of these built-in spaces prior to installing them into the floor.
- F. Racking
 - 1. With solid or engineered wood flooring installed over concrete or a wood panel subfloor and joist systems that meets or exceeds minimum requirements, properly staggered end-joints are an appearance/aesthetic consideration only.
 - 2. When racking (or laying out the floor) prior to installation, be sure to work from multiple bundles or packages to ensure color and length variation.
 - 3. Flooring warranties do not typically cover materials with visible defects once they are installed. Installation is considered acceptance of the product aesthetic quality.
 - 4. Distribute lengths randomly and pull from multiple bundles.
 - 5. Avoid "H" patterns when possible.
 - 6. Avoid any discernible pattern in adjacent runs such as blatant stair-steps or equal end-joint offsets in sequential rows. Cutting a variety of starter boards from full length boards will assist in "randomizing" joints in products of equal or limited lengths.
 - 7. End joints of adjacent boards should not be installed in close proximity to each other. In general, End-joint staggering, row-to-row should be a minimum of twice the width of the flooring being installed (e.g., 6" stagger for 3" wide material). Wider width materials may be more difficult to maintain these staggers due to the product length limitations.
- G. Precut and lay out a starter row along the entire length of the working line.
- H. An anchor row is sometimes beneficial to the installation.
 - 1. An anchor row is one that may be set and secured to the substrate to provide a stationary point to be pushed against so flooring doesn't move during installation of the remaining floor.
 - 2. Creating an anchor row may include setting a section of flooring in the flooring adhesive the day prior to beginning the install or by setting a temporary starter row using a fastening mechanism, pressure sensitive tape, or temporary adhesive to create a backer for the flooring to be pulled against.
- I. Many wood flooring adhesives are designed to be used in a wet-lay installation method, where you are able to spread the adhesive and begin to install the flooring immediately. Some adhesives may require flash-time prior to laying the flooring into the adhesive. Read the adhesive instructions prior to installation of any wood flooring.
- J. Spread the adhesive with the appropriate trowel. Only apply as much adhesive as can be installed within the adhesive open-time period (see manufacturer's recommendations for open-time based on adhesive type). Avoid excessive adhesive thickness and inconsistent application by passing the trowel evenly through the adhesive as recommended by the manufacturer.
- K. Lay the flooring into the adhesive, in accordance with the wood flooring and adhesive manufacturer's instructions. Follow the flooring manufacturer's instruction for tongue and groove (T&G) direction and placement.
- L. Correctly position the flooring and press down firmly.
- M. Tapping blocks, pull-bars, and straps may be used to drive flooring tight during installation. Be certain to only use tapping blocks, pull-bars, or straps that do not damage the flooring.
- N. Runs of flooring should generally be installed straight. Unless otherwise required, the installed wood flooring should not deviate from a straight line more than 3/16" in 10'.
- O. Periodically lift boards immediately after installation and at regular intervals to ensure proper slab coverage and adhesive transfer to the back of the flooring from subfloor is achieved.
- P. Spline/slip-tongue: Spline or slip-tongue is used to maintain T&G within the entire flooring system. Use spline/slip-tongue to fit the specific flooring profile.
 - 1. Use spline anytime the flooring direction changes, at all headers or flush transitions, and when reversing installation direction such as starting in the center of a layout or back-filling.

2. To install a spline/slip-tongue:
 - a. Cut to length.
 - b. Apply PVA glue or aliphatic resin (carpenters glue) to the bottom side of the receiving groove.
 - c. Insert the slip-tongue.
- Q. Use quick-release tape, straps, or tensioners to maintain a tight floor when necessary, and as suggested by the adhesive manufacturer.
- R. Nail-assisted glue-down:
 1. With full-spread installations over wood subfloors or sleepers/screeds, it may be necessary or helpful to blind-nail the flooring into the wood subfloor periodically.
 2. This method may be appropriate where flooring needs to be driven tight during the installation.
 - a. There is no recommended nailing schedule for this method, as the fasteners are strictly used as a supplement to the glue-down method.
- S. If recommended by the adhesive manufacturer, roll the floor with the proper weight roller.
- T. Clean all adhesive residue from the flooring surface using a proper adhesive remover as recommended by the adhesive and flooring manufacturer. Use the recommended cleaner to remove any residue that may have been left from the proper adhesive remover. Do not use a product or process that could damage the finished flooring.
- U. Allow the floor to set for at least 24 hours, or as otherwise directed by the adhesive manufacturer, before allowing foot traffic.
- V. Be sure the adhesive has had adequate time to dry and finish off-gassing before any topcoats or finish get applied to the floor.

PART V

End-Grain Installation



- A. Determine the layout before adhering end-grain blocks to the substrate.
- B. Begin the installation at a point opposite of the main entrance in order to minimize walking across a newly glued-down installation. Wall-

layout option is the most appropriate for glue-down installations. Refer to the Layout chapter for more-detailed information.

- C. Undercut door casings and jambs. Remove any existing base, shoe mold, or doorway thresholds. These items can be replaced after installation.
- D. Snap a working line parallel to the starting wall, accounting for necessary expansion space.
- E. Expansion space:
 1. In facilities that do not have consistent climate controls in place, shrink/swell should be accounted for within the installation.
 2. End-grain flooring often requires expansion space to be added within the flooring system, based on the season of installation and the tangential shrink/swell value of the species being installed.
 3. Many end-grain installations are installed with a slight gap between each block to allow for normal swelling. Depending on the size of the end-grain blocks, it is not uncommon to have 1/8"-1/4" (3-5 mm) expansion built into the system throughout the installation.
 4. The typical rule of thumb for perimeter expansion is to maintain 3/4" space at all vertical obstructions.
- F. Racking: due to the varying wood grain patterns and other distinguishing characteristics that are prevalent in each individual end block, make sure to lay out the blocks in a random pattern.
- G. An anchor row is sometimes beneficial to the installation.
 1. This anchor row is one that may be set and secured to the subfloor to provide a stationary point to be pushed against so flooring doesn't move during installation of the remaining floor. Creating an anchor row may include setting a section of flooring in the flooring adhesive the day prior to beginning the install.
 2. Set a temporary starter row using a fastening mechanism, pressure-sensitive tape, or temporary adhesive to create a backer for the flooring to be pulled against.
- H. Many wood flooring adhesives are designed to be used in a wet-lay installation method, where you are able to spread the adhesive and begin to install the flooring immediately. Some adhesives may require flash-time prior to laying the flooring into the adhesive. Read the adhesive instructions prior to installation of any wood flooring.
- I. Spread the adhesive with the appropriate-size trowel. Only apply as much adhesive as can be installed within the adhesive open-time period (see manufacturer's recommendations for open-time based on adhesive type). Avoid excessive adhesive thickness and inconsistent application by passing the trowel evenly through the adhesive as recommended by the manufacturer.

- J. Lay the flooring into the adhesive, in accordance with the wood flooring and adhesive manufacturer's written instructions. Correctly position the flooring and press down firmly.
- K. During installation, use a white/non-marring flooring mallet on each end every block to ensure all are embedded properly into the adhesive. Tapping blocks and pull-bars also may be used to drive flooring tight during installation. Be certain to only use tapping blocks or pull-bars that do not damage the flooring.
- L. Periodically lift the blocks immediately during installation and at regular intervals to ensure proper slab coverage and adhesive transfer to the back of the flooring from subfloor is achieved.
- M. Use quick-release tape to maintain a tight floor when necessary, and as suggested by the adhesive manufacturer. Maintain adequate expansion on all four sides of each block when conditions are expected to fluctuate.
- N. If recommended by the adhesive manufacturer, roll the floor with the proper weight roller.
- O. Clean all adhesive residue from the flooring surface using a proper adhesive remover as recommended by the adhesive and flooring manufacturer. Be sure and use the recommended cleaner to remove any residue that may have been left from the proper adhesive remover. Do not use a product or process that could damage the finished flooring.
- P. Allow the floor to set for at least 24 hours, or as otherwise directed by the adhesive manufacturer, before allowing foot traffic.
- Q. Be sure the adhesive has had adequate time to dry and finish off-gassing before any topcoats of finish get applied to the floor.

PART VI

Cork Flooring Glue-Down Installation



Similar to wood, cork is hygroscopic, meaning it is subject to the normal behavior of shrinking and swelling during periods of low and high humidity. In general, solid and engineered cork tiles and planks

may be installed below, on, or above grade in properly conditioned spaces.

- A. Check with the cork flooring manufacturer and the moisture meter manufacturer for the proper process of setting your meter to test the cork flooring. Check the cork flooring moisture content to ensure it is compatible with the jobsite conditions.
- B. For solid or engineered cork intended to be used as a finished floor covering, follow these instructions unless otherwise directed by the cork manufacturer:
 - 1. Determine the layout before adhering any cork flooring to the substrate.
 - 2. Installation of a smooth $\frac{1}{4}$ " (or greater) underlayment-grade plywood is often required to be installed over the existing substrate for any glue-down cork installation. Fill cracks and sand uneven areas to create a smooth substrate for this resilient material. Any imperfections in the substrate will telegraph through the cork flooring.
 - 3. Mix cork tiles or planks from various cartons to maintain natural color and pattern variation.
 - 4. Due to the resilient nature of cork, solid cork products may often be "net-fit" to adjoining flooring and vertical obstructions. With engineered cork, follow the cork flooring manufacturer instructions for proper perimeter expansion, and installation method.
 - 5. Water-based contact adhesives are most-often recommended for glue-down installation of cork tiles or planks. Follow the flooring manufacturer's instructions on which adhesive to use, proper installation methods, necessary flash-time, and application methods.
 - 6. Use a subfloor primer as directed by the adhesive manufacturer.
 - 7. Always test for proper adhesion prior to proceeding with the installation.
 - 8. Continue the process with each tile or plank.
 - 9. Lay the cork in place, and then set it by rolling the entire tile or plank with a small hand-held j-roller, or hitting with a white/non-marring flooring mallet, or as otherwise indicated by the flooring manufacturer. Contact adhesives that require "setting" with a mallet are considered "set" with the impact of the mallet.
 - 10. If recommended by the adhesive manufacturer, roll the floor with the proper weight roller.
 - 11. Allow the floor to set for at least 24 hours, or as otherwise directed by the adhesive manufacturer, before allowing foot traffic.
 - 12. Be sure the adhesive has had adequate time to dry and finish off-gassing before any topcoats of finish get applied to the floor.