

## Section II

### Subfloor Guidelines & Specifications

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## Chapter 4

### Wood Subfloor Guidelines

Note: Always follow the wood flooring manufacturer's recommendation for a proper subfloor.

#### Part I

##### Wood Subfloor Specifications

- A. Subfloor panels should conform to U.S. Voluntary Product Standard PS1-07, Construction and Industrial Plywood and/or US Voluntary PS 2-04 and/or Canadian performance standard CAN/CSA 0325.0-92 Construction Sheathing. Other CSA standards also apply.
- B. Solid-board subflooring should be  $\frac{3}{4}$ " x  $5\frac{1}{2}$ " (1" x 6" nominal), Group 1 dense softwoods, No. 2 Common, kiln-dried to less than 15 percent moisture content.
- C. Both CD Exposure 1 plywood and OSB Exposure 1 subfloor panels are appropriate subflooring materials, but the proper thickness of the material will be determined by the factors noted below in Part IV, Panel Products Subflooring, E, Acceptable Panel Subfloors.

#### Part II

##### Subfloor Moisture

Note: The National Association of Home Builders' Green Home Building Guidelines contain the following directive under Section 5.3.8: "NAHB Model Green Home Building Guidelines, Section 5.3.8: Check moisture content of wood flooring before enclosing on both sides. Ensure moisture content of subfloor/substrate meets the appropriate industry standard for the flooring material to be installed."

- A. For solid strip flooring (less than 3" wide), there should be no more than 4 percent moisture content difference between properly acclimated wood flooring and subflooring materials.
- B. For wide-width solid flooring (3" or wider), there should be no more than 2 percent difference in moisture content between properly acclimated wood flooring and subflooring materials.

#### Part III

##### Subfloor Flatness and Integrity

- A. Wood subfloors must be flat, clean, dry, structurally sound, free of squeaks and free of protruding fasteners.
  1. For installations using mechanical fasteners of  $1\frac{1}{2}$ " and longer, the subfloor should be flat to within  $\frac{1}{4}$ " in 10 feet or  $\frac{3}{16}$ " in 6 feet radius.
  2. 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.
- B. If peaks or valleys in the subfloor exceed the tolerances specified above, sand down the high spots and fill the low spots with a leveling compound or other material approved for use under wood flooring. However, it is the builder's or general contractor's responsibility to provide the wood-flooring contractor with a subfloor that is within the tolerances listed above.

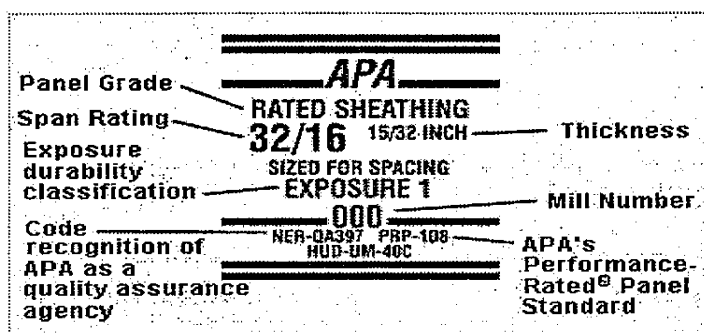


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When possible, check the back of the subfloor panel for American Plywood Association (APA) rating.

- C. Inspect the subfloor carefully. If there is movement or squeaks in the subfloor, refasten the subfloor to the joists in problem areas.
- D. Protruding fasteners are easily remedied by driving those fasteners deeper into the subfloor.

#### Part IV

##### Panel Products Subflooring

- A. For panel products subflooring, check for loose panels and re nail or screw down loose panels securely.
- B. 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.
- C. Also check for delaminated or damaged areas and repair those areas as needed.
- D. Make sure the subfloor is free of debris before beginning installation.
- E. Acceptable Panel Subfloors: Truss/joist spacing will determine the minimum acceptable thickness of the panel subflooring.
  - 1. 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.
  - 2. On truss/joist spacing of more than 16", up to 19.2" (488mm) o/c, the standard is minimum 3/4" (23/32", 18.3mm) T&G CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4' x 8' sheets, glued and mechanically fastened, or minimum 3/4" (23/32", 18.3mm) OSB Exposure 1 subfloor panels, 4' x 8' sheets, glued and mechanically fastened. When possible, check the back of the subfloor panel for American Plywood Association (APA) rating.
  - 3. 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 minimum 7/8" OSB Exposure 1 subfloor panels, 4' x 8' sheets, glued and mechanically fastened – or two layers of subflooring. 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.
    - a. For double-layer subfloors, the first layer should consist of nominal 3/4" (23/32", 18.3mm) CD Exposure 1 Plywood subfloor panels (CDX), 4' x 8' sheets or nominal 3/4" (23/32", 18.3mm) OSB Exposure 1 subfloor panels, 4' x 8' sheets. The second layer should consist of nominal 1/2" (15/32", 11.9mm) CD Exposure 1 plywood subfloor panels, (Exposure 1) 4' x 8' sheets. The 1/2" plywood should be offset by 1/2 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-shanked nails or staples.
- F. Fastening and Spacing Specifications
  - 1. Follow the panel manufacturer's recommendations for spacing and fastening.
  - 2. Typical panel spacing and fastening requirements for truss/joist systems call for approximately 1/8" (3.2mm) expansion space around the perimeter of each panel, with panels fastened every 12" (305 mm) along intermediate supports.
  - 3. Edge swell should also be flattened. This can usually be accomplished by using an edger sander.

#### Part V

##### Solid Board Subflooring

- A. 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 to less than 15% MC. Refer to Chapter 2, Acclimation and Conditioning of Wood Flooring, for proper subfloor moisture content at time of installation.
- B. 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.
- C. Some types of wood flooring should not be installed directly over solid board subflooring.
  - 1. Thin-classification solid strip flooring must have a 3/8" or better plywood underlayment installed over solid board subflooring.

2. Parquet flooring cannot be installed directly to solid board subfloors. A parquet installation over solid board subflooring requires 3/8" or better underlayment panels, nailed on 6" minimum grid pattern using ring-shanked nails or staples.
- D. Some engineered flooring cannot be installed directly to solid board subfloors. (See wood flooring manufacturer's recommendations.)

## Chapter 5

### Concrete Subfloor Guidelines

Note: Always follow the wood flooring and adhesive manufacturer's recommendation for a proper subfloor.

#### Part I

##### Concrete Subfloor Specifications

- A. Subfloor must be flat.
  - 1. Make sure the concrete slab is flat to the wood flooring manufacturer's specification. Typically, manufacturers will specify a flatness tolerance of 1/8" in a 6-foot radius and or 3/16" in a 10-foot radius.
  - 2. If the slab is out of specification, consider grinding, floating or both. 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.
  - 3. 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.
- B. Subfloor must be dry.
  - 1. See Chapter 3, Moisture Guideline Testing and Vapor Retarders.
  - 2. Concrete moisture meters and other tests can be useful in identifying moisture problem areas. However, 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 moisture content of the slab. See Chapter 3, Moisture Guideline and Vapor Retarders.
  - 3. If a slab tests too high in vapor emission to glue a floor down, consider using a vapor retarder type product, installing a vapor retarder and a plywood subfloor or using an alternative installation method.
  - 4. Concrete slabs with a calcium chloride reading of more than 3 require use of a vapor retarder with a perm rating of 1 or less. It is strongly recommended to use an impermeable vapor retarder with a perm rating of .13 or less, such as 6 mil polyethylene film.
- C. Slab must be:
  - 1. Minimum 3000 psi.
  - 2. Free from non-compatible sealers, waxes, oil, paint, drywall compound, etc.
    - a. 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.
- D. Do not attempt to glue a wood floor over a chalky or soft concrete slab.
- E. Burnished or slick slabs may require screening or sanding with a 30-grit abrasive.
- F. Specifications for lightweight concrete:
  - 1. Make sure the concrete is well bonded to the subfloor. Check for hollow spots, cracks and loose areas.
  - 2. As with on-grade concrete subfloors, make sure the concrete is clean, flat to specification and dry.
  - 3. 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. (See Chapter 6, Installing a Subfloor Over Concrete.) If the psi of the concrete is unknown, use the floated subfloor installation method or contact the adhesive manufacturer.
  - 4. Rule of thumb: Draw a nail across the top; if it leaves an indentation, it is probably lightweight concrete.

## Chapter 6

### Installing a Subfloor Over Concrete

Note: Always follow the manufacturer's recommendation for a proper subfloor.

#### Part I

##### Direct Gluing a Subfloor Over Concrete

- A. Always follow the adhesive manufacturer's recommendation for proper application, proper adhesive and correct trowel notch and spread rate.
- B. If necessary, add vapor retarder recommended by the adhesive manufacturer before applying adhesive.

#### Part II

##### Floated Subfloor

- A. In on-grade and below-grade applications, always add vapor retarder before applying underlayment.
- B. In above-grade applications, follow the flooring manufacturer's recommendations.
- C. A vapor retarder is recommended anytime solid  $\frac{3}{4}$ " wood flooring is installed over concrete. A vapor retarder is required for installation over concrete with a calcium chloride reading greater than 3 pounds, a relative humidity reading of greater than 75%, or a calcium carbide (CM) reading of greater than 2.5%.
- D. Floated Subfloor System
  1. Materials
    - a. 2 layers minimum  $\frac{3}{8}$ " (10mm) minimum CD Exposure 1 Plywood subfloor panels (CDX) 4' x 8' sheets.
  2. Installation method
    - a. Place the first plywood layer with edges parallel to wall, without fastening. Leave  $\frac{3}{4}$ " space between wall and plywood.
    - b. Plywood panels should be placed with  $\frac{1}{8}$ " gaps between sheets.
    - c. Lay the second layer perpendicular or at 45 degree angle to the first.
    - d. Plywood panels should be placed with  $\frac{1}{8}$ " gaps between sheets and a  $\frac{3}{4}$ " minimum expansion space at all vertical obstructions and wall lines.
    - e. 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.
- E. Alternate Subfloor System
  1. Materials
    - a. Use minimum  $\frac{3}{4}$ " (23/32", 18.3mm) CD Exposure 1 Plywood sheathing, 4' x 8' sheets.
  2. Installation method
    - a. Cut sheets to 16" x 8' or smaller panels, scored on back  $\frac{3}{8}$ " deep a minimum of every 12" across width.
    - b. 16" planks oriented perpendicular or diagonally to direction of flooring.
    - c. Panels staggered every 2', and spaced  $\frac{1}{8}$ " between ends, with  $\frac{3}{4}$ " minimum expansion space at all vertical obstructions.

#### Part III

##### Glue-Down Subfloor

- A. Always follow the adhesive manufacturer's recommendation for proper subfloor, spread rate and trowel notch.
- B. If necessary, add vapor retarder before applying underlayment. A vapor retarder is recommended anytime solid  $\frac{3}{4}$ " wood flooring is installed over concrete.
- C. Glue-Down Subfloor System:
  1. Materials
    - a. Use minimum  $\frac{3}{4}$ " (23/32, 18.3mm) CD Exposure 1 Plywood subfloor panels, (Exposure 1), 4' x 8' sheets.
  2. Installation method
    - a. Cut the plywood panels to 2' x 8' or 4' x 4' sections.

- b. Score the back of the panels  $\frac{1}{2}$  the thickness on a 12" x 12" grid.
- c. Apply an adhesive approved for the installation of plywood, per the plywood manufacturer's recommendations.
- d. Lay sections in a staggered joint pattern in the adhesive, with  $\frac{1}{8}$ " spacing between sheets, and  $\frac{3}{4}$ " minimum expansion space at walls and all vertical obstructions.

#### **Part IV**

##### **Nail-Down Subfloor**

- A. Always follow the manufacturer's recommendation for proper subfloor.
- B. In on-grade and below-grade applications, always add vapor retarder before applying underlayment. In above-grade applications, follow the flooring manufacturer's recommendations.
- C. A vapor retarder is recommended anytime solid  $\frac{3}{4}$ " wood flooring is installed over concrete.
- D. Nail-Down Subfloor System Over Concrete
  - 1. Materials
    - a. Minimum: Use minimum  $\frac{3}{4}$ " (23/32, 18.3mm) CD Exposure 1 Plywood subfloor panels (CDX), 4' x 8' sheets.
  - 2. Installation method
 

Note: Fasteners may be powder-driven pins, pneumatic driven nails, screws, deformed pins, or other fasteners suitable for concrete application. Check with fastener manufacturer for specification such as length, drill size, and/or shot load where applicable.

    - a. Stagger panel joints allowing approximately  $\frac{1}{8}$ " expansion space around all panels to prevent edge peaking due to compression caused by panel swell.
    - b. Allow  $\frac{3}{4}$ " minimum expansion space at all vertical obstructions.
    - c. Panels should be mechanically fastened. For powder load or pneumatic pressure information, contact your local supplier.
    - d. Nailing requirements, minimum 32 shots per 4' x 8' panel.
    - e. Areas with higher humidity may require additional fasteners.

#### **Part V**

##### **Screed System**

- A. Solid  $\frac{3}{4}$ ", 25/32" and 33/32" tongue-and-groove strip flooring may be installed directly to screeds.
- B. Engineered wood flooring less than  $\frac{3}{4}$ " (23/32") thick, thin-classification strip flooring (including  $\frac{1}{2}$ ") and solid plank flooring (3" or wider) cannot be installed directly to screeds.
- C. For engineered flooring less than  $\frac{3}{4}$ " thick, thin-classification strip, and for solid plank (3" and wider), the screed system must be overlaid with proper subflooring. The screed system must be overlaid with nominal  $\frac{3}{4}$ " (23/32", 18.3mm) Exposure 1, or nominal  $\frac{5}{8}$ " (19/32", 15.1mm), Exposure 1, CDX plywood subfloor panels or nominal  $\frac{3}{4}$ " (23/32", 18.3mm) OSB underlayment properly spaced and oriented perpendicular to screed direction. All joints must be staggered.
- D. Installation method. See Appendix I, Installation Over Screeds.