



# Wall Construction

**AN EXCERPT OF THE ENGINEERED  
WOOD CONSTRUCTION GUIDE**





## WALL CONSTRUCTION

Walls are a critical structural component in any structure. Building codes require that walls resist wind pressures and wall-racking forces and provide weather protection. Builders and designers can choose from a variety of wall sheathing products and wall systems. This section provides an overview of several commonly used systems and shows details on how wood structural panels can be used to meet fundamental requirements in wall applications.

### Continuously Sheathed Wood Walls

Continuous sheathing with plywood or OSB panels, as shown in Figure 8, has gained popularity because it offers several advantages to builder and homeowner alike and plays a highly beneficial role in the overall integrity of a home. Continuous wood structural panel sheathing contributes to a structure's ability to handle uplift loads, lateral loads, and wind pressures while providing connections to the roof and protecting occupants. It is an easy, economical way to meet International Residential Code (IRC) bracing requirements while helping builders maximize energy efficiency. Continuous wood panel sheathing also serves as an excellent, code-compliant nail base for cladding attachment when the proper number and size of fasteners are used.

### APA Panel Wall Sheathing

APA RATED SHEATHING meets building code wall sheathing requirements for wind pressures and wall bracing (Figure 9). Continuous wood structural panel wall bracing provides the greatest flexibility when bracing walls with window and door openings. It is most commonly used directly under siding, but can also be used in combination with continuous insulated sheathing.

Recommended wall sheathing spans with brick veneer or masonry are the same as those for panel sheathing (see Table 22). See Figure 10 for installation recommendations.

Panel recommendations for preframed wall sections are the same as for built-in-place walls.

**Note:** To minimize the potential for panel buckling, gluing of wall sheathing to framing is not recommended, except when recommended by the adhesive manufacturer for wall sheathing that already has been permanently protected by siding.

#### TYPICAL SHEATHING TRADEMARKS

APA	APA	APA
RATED SHEATHING <b>24/0</b> SIZED FOR SPACING EXPOSURE 1 THICKNESS 0.354 IN. <b>000</b> PS 2-10 SHEATHING PRP-108 HUD-UM-40 3/8 CATEGORY	RATED SHEATHING <b>24/16</b> SIZED FOR SPACING EXPOSURE 1 THICKNESS 0.418 IN. <b>000</b> PS 2-10 SHEATHING PRP-108 HUD-UM-40 7/16 CATEGORY	RATED SHEATHING STRUCTURAL I <b>32/16</b> SIZED FOR SPACING EXPOSURE 1 THICKNESS 0.451 IN. <b>000</b> PS 1-99 C-D PRP-108 15/32 CATEGORY

FIGURE 8

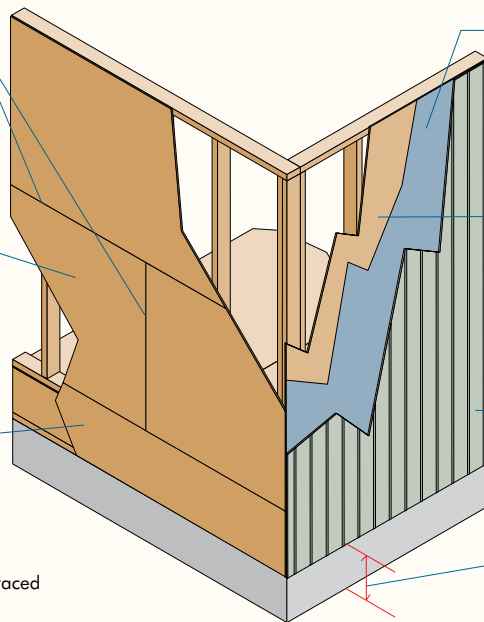
**APA PANEL WALL SHEATHING**

1/8" spacing is recommended at all edge and end joints unless otherwise indicated by panel manufacturer

APA RATED SHEATHING applied with strength axis across studs<sup>a</sup>

Filler strip if required

a. Check local building codes for horizontal blocking requirements between studs for braced or engineered shear wall segments.



Building paper or other code-recognized weather-resistive barrier

APA RATED SHEATHING applied with strength axis parallel to studs<sup>a</sup>

Siding

6" minimum clearance, siding to grade

FIGURE 9

**WALL BRACING**

Block unsupported edges at wall bracing locations

Min. 3/8 Performance Category APA RATED SHEATHING<sup>a</sup>

a. See Table 22 for nail requirements.

For additional information on wall bracing, visit [www.apawood.org/walls](http://www.apawood.org/walls).

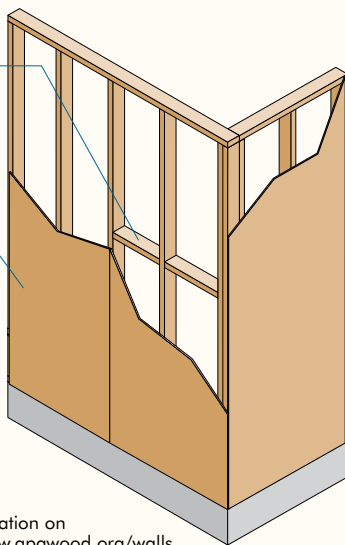


FIGURE 10

**BRICK VENEER OVER APA PANEL SHEATHING**

Building paper or other code-recognized weather-resistive barrier required

1" air space

Brick veneer or masonry

"Weep holes" in bottom course every 24"

APA RATED SHEATHING

Extend flashing up behind weather-resistive barrier at least 6"

Hold panel edge 1/2" above base flashing

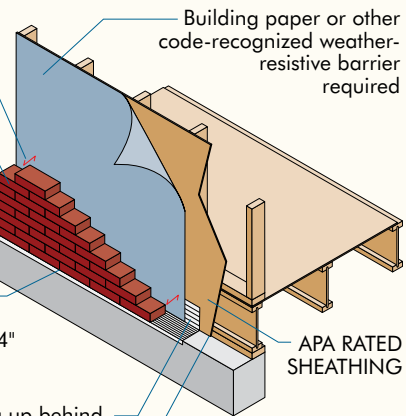


TABLE 22

**APA RATED SHEATHING APPLIED DIRECT-TO-STUDS<sup>a,b,c</sup>**

Minimum Nail <sup>d</sup>		Minimum Wood Structural Panel Span Rating	Minimum Panel Performance Category	Wall Stud Spacing (in.)	Panel Nail Spacing		Ultimate Design Wind Speed (mph)		
Shank Diameter (in.)	Minimum Penetration (in.)				Edges (in. o.c.)	Field (in. o.c.)	Wind Exposure Category		
							B	C	D
0.113	1.5	24/0, Wall-16 and Wall-24	3/8	16	6	12	140	115	110
		24/16, Wall-24	7/16	16	6	12	140	130	115
						6	190	160	140
0.131	1.75	24/16, Wall-24	7/16	16	6	12	170	140	135
						6	190	160	140
				24 or less	6	12	140	115	110

a. Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

b. Table is based on wind pressures acting toward and away from building surfaces, at 30-ft height in wall Zone 5 (corners) with smallest effective area, per Chapter 30 of ASCE 7-10 and Section R301.2 of the 2015 IRC, stud specific gravity = 0.42.

c. Supported panel joints shall occur approximately along the center line of framing with a minimum bearing of 1/2 inch.

d. See Table 6, page 14, for nail dimensions.

## Wood Structural Panel Wall Bracing and Shear Walls

Wood structural panel wall bracing and shear walls are used to resist racking forces caused by lateral loads from wind or seismic events. Wall bracing and shear walls serve the same purpose, to resist wall-racking forces, but they have distinct differences, as explained below. While all of the wall systems presented here will provide sufficient wall bracing strength under normal conditions in residential and light-frame construction, engineered shear walls may be desirable or required in areas of the country with frequent seismic activity or high wind loads. Shear walls are also integral to commercial and industrial construction.

### Wall Bracing

Wall bracing is typically a part of conventional prescriptive construction as found in 2015 International Building Code (IBC) Section 2308 or the International Residential Code (IRC) Chapter 6. Wall bracing is prescribed in a how-to format, and braced walls generally do not require hold-down devices or have significant nailing requirements. Usually, there is no engineering required when using wall bracing since the “solution” is prescribed. For structures or portions of them that do not meet the prescribed construction parameters in the IBC or IRC, engineered design is required.

Meeting the bracing requirements is easy when using wood structural panel wall sheathing because of its inherent strength. More information is available at [www.apawood.org/walls](http://www.apawood.org/walls).

## Shear Walls

The engineered version of wall bracing is a shear wall. Shear walls are designed by an engineer to resist the specific forces determined by engineering analysis. Shear walls have specific design values depending on their construction, fastener spacing, fastener size, sheathing thickness and framing species. Table 23 shows the Allowable Stress Design values for single-sided sheathed wood structural panel shear walls. Shear walls are also permitted to be designed to account for openings and with both sides of the wall sheathed. They usually require hold-downs to resist overturning of wall segments, as shown in Figure 11. More information on designing with shear walls is available in the APA publication *Design/Construction Guide: Diaphragms and Shear Walls*, Form L350.

Either APA RATED SHEATHING or all-veneer plywood APA RATED SIDING (and other APA RATED SIDING panels that qualify on a proprietary basis) can be used in shear wall design. The data presented here give maximum shears for walls with APA RATED SHEATHING, with plywood APA RATED SIDING installed directly to studs (APA Sturd-I-Wall), and with panels applied over gypsum sheathing for walls required to be fire-rated from the outside.

### TYPICAL SHEATHING TRADEMARKS

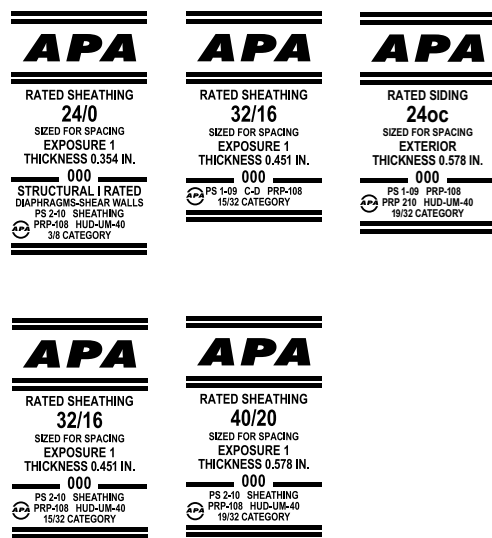


FIGURE 11

### SHEAR WALL HOLD-DOWN ANCHOR

Shear wall overturning moments may be transferred by a fabricated steel bracket such as this. Regular foundation bolts may be all that is required in some cases depending on engineering analysis.

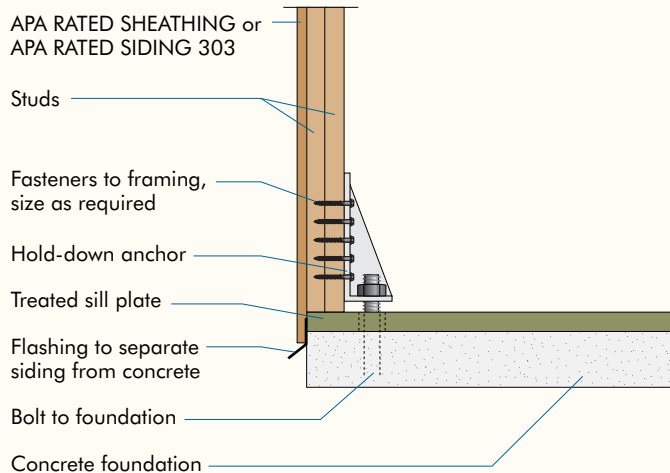


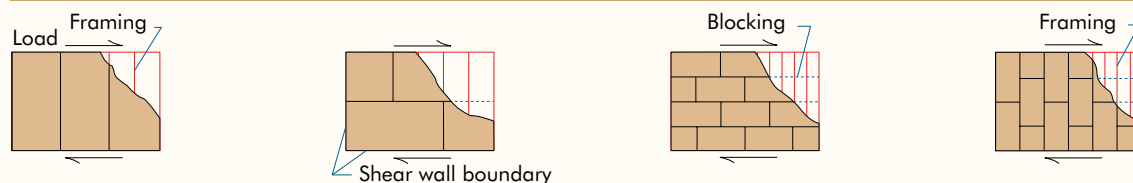


TABLE 23

**ALLOWABLE SHEAR (POUNDS PER FOOT) FOR APA PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS-FIR, LARCH, OR SOUTHERN PINE<sup>a</sup> FOR WIND<sup>b,c,d,e,f</sup> OR SEISMIC<sup>c,d,e,g</sup> LOADING**

Panel Grade	Minimum Nominal Panel Thickness (in.)	Minimum Nail Penetration in Framing (in.)	Panels Applied Direct to Framing				Panels Applied Over 1/2" or 5/8" Gypsum Sheathing					
			Nail Size (common or galvanized box) <sup>h</sup>	Nail Spacing at Panel Edges (in.)				Nail Size (common or galvanized box)	Nail Spacing at Panel Edges (in.)			
				6	4	3	2 <sup>i</sup>		6	4	3	2 <sup>i</sup>
APA STRUCTURAL I grades	3/8	1-3/8	8d	230 <sup>j</sup>	360 <sup>j</sup>	460 <sup>j</sup>	610 <sup>j</sup>	10d	280	430	550 <sup>j</sup>	730
	7/16			255 <sup>j</sup>	395 <sup>j</sup>	505 <sup>j</sup>	670 <sup>j</sup>					
	15/32	1-1/2	10d	280	430	550	730	—	—	—	—	
	15/32			340	510	665 <sup>j</sup>	870					
APA RATED SHEATHING; APA RATED SIDING <sup>m</sup> and other APA grades except species Group 5	5/16 or 1/4 <sup>k</sup>	1-1/4	6d	180	270	350	450	8d	180	270	350	450
	3/8			200	300	390	510		200	300	390	510
	3/8	1-3/8	8d	220 <sup>j</sup>	320 <sup>j</sup>	410 <sup>j</sup>	530 <sup>j</sup>	10d	260	380	490 <sup>j</sup>	640
	7/16			240 <sup>j</sup>	350 <sup>j</sup>	450 <sup>j</sup>	585 <sup>j</sup>					
	15/32			260	380	490	640					
	15/32	1-1/2	10d	310	460	600 <sup>j</sup>	770	—	—	—	—	
	19/32			340	510	665 <sup>j</sup>	870	—	—	—	—	
	APA RATED SIDING <sup>m</sup> and other APA grades except species Group 5			Nail Size (galvanized casing)					Nail Size (galvanized casing)			
5/16 <sup>k</sup>		1-1/4	6d	140	210	275	360	8d	140	210	275	360
3/8		1-3/8	8d	160	240	310	410	10d	160	240	310 <sup>j</sup>	410

- a. For framing of other species: (1) Find specific gravity for species of lumber in the AWC National Design Specification (NDS). (2) For common or galvanized box nails, find shear value from table above for nail size for actual grade. (3) Multiply value by the following adjustment factor: Specific Gravity Adjustment Factor =  $[1 - (0.5 - SG)]$ , where SG = specific gravity of the framing. This adjustment shall not be greater than 1.
- b. For wind load applications, the values in the table above shall be permitted to be multiplied by 1.4.
- c. All panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space nails maximum 6 inches o.c. along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thicknesses, space nails maximum 12 inches o.c. on intermediate supports. Fasteners shall be located 3/8 inch from panel edges.
- d. Where panels applied on both faces of a wall and nail spacing is less than 6 inches o.c. on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3-inch nominal or thicker at adjoining panel edges and nails on each side shall be staggered.
- e. Galvanized nails shall be hot-dip or tumbled.
- f. For shear loads of normal or permanent load duration as defined by the NDS, the values in the table above shall be multiplied by 0.63 or 0.56 respectively.
- g. In Seismic Design Category D, E, or F, where shear design values exceed 350 pounds per lineal foot, all framing members receiving edge nailing from abutting panel edges shall not be less than a single 3-inch nominal member, or two 2-inch nominal members fastened together to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered in all cases. See IBC or AWC *Special Design Provisions for Wind and Seismic* (SDPWS) for sill plate size and anchorage requirements.
- h. See Table 6, page 14, for nail dimensions.
- i. Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where nails are spaced 2 inches o.c. Check local code for variations of these requirements.
- j. Allowable shear values are permitted to be increased to values shown for 15/32-inch sheathing with same nailing provided:
- studs are spaced a maximum of 16 inches on center, or
  - panels are applied with long dimension across studs.
- k. 3/8-inch or APA RATED SIDING 16 oc is minimum recommended when applied direct to framing as exterior siding.
- l. Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where 10d nails (3" x 0.148") having penetration into framing of more than 1-1/2 inches are spaced 3 inches o.c. Check local code for variations of these requirements.
- m. Values apply to all-veneer plywood APA RATED SIDING panels only. Other APA RATED SIDING panels may also qualify on a proprietary basis. APA RATED SIDING 16 oc plywood may be 11/32 inch, 3/8 inch or thicker. Thickness at point of nailing on panel edges governs shear values.

**Typical Layout for Shear Walls**

@seismicisolation

## Energy Efficiency of Wood-Frame Walls

In residential construction, exterior walls are comprised of solid wall sections, windows, and doors. Conductive heat transfer through the walls is determined by the heat resistance or R-values of the different components of the wall assembly. Typical components include framing, interior gypsum, exterior wall sheathing, exterior claddings, insulation, and interior and exterior air films.

Heat transfer occurs through three parallel paths in the wall:

1. Through areas of the wall containing cavity insulation. This path usually has the greatest amount of heat resistance because there is no framing material to displace insulation. While wood framing is a good insulator, heat is transferred through framing components at a higher rate than through insulation between framing.
2. Through areas of the wall containing framing studs and plates, including all of the vertical framing members, top and bottom wall plates, and full-cavity width blocking.
3. Through areas of the wall containing framing headers that carry structural loads above window and door openings. Often, the structural headers can accommodate insulation, or the structural portion of the header can be reduced in thickness to provide space for insulation.

When calculating the overall R-value or U-factor of a solid exterior wall assembly (excluding fenestrations), the R-values of each component through the entire thickness of the wall in each of the three parallel paths must first be determined. The R-value for a given path is the sum of the R-values of all of the components within the path. Each path or section R-value is then converted to a U-factor and multiplied by the percentage of the solid wall area that the section represents. (Note that U-factors are generally the inverse of R-values and are used to evaluate multiple heat flow paths within a single assembly, such as walls.) These values are summed to determine the overall U-factor for the solid wall.

For more information on energy-efficient wall construction, see *Energy Conservation: Insulating Exterior Walls* on page 87, or *IECC Compliance Options for Wood-Frame Wall Assemblies*, Form P320.

## Advanced Framing

“Advanced framing” refers to a suite of framing techniques that increase energy efficiency and optimize the use of building materials, reducing waste and cost for builder and homeowner alike. Advanced framing techniques include using 2x6 wood studs placed 24 inches on center (in lieu of 2x4 studs at 16 inches on center), designing corners and headers with insulated spaces, and continuous wood panel sheathing, see Figure 12. These small changes in framing technique can greatly increase the energy efficiency of homes, and implementing the techniques requires little in the way of new skills or additional cost.

Conventional framing typically consists of 2x4 or 2x6 wood framing spaced 16 inches on center, double top plates, three-stud corners, multiple jack studs, double or triple headers, redundant cripple studs and unnecessary framing members.

Advanced framing typically includes 2x6 wood framing spaced at 24 inches on center insulated corner junctions, minimal use of jack studs and cripples, and the elimination of redundant studs and unnecessary blocking and bridging. Correctly sized load-bearing headers are used over openings in load-bearing walls; simple non-load-bearing headers are used in non-load-bearing walls, where applicable.

In addition to improving framing efficiency, advanced framing also boosts whole wall R-value (resistance to heat flow) by maximizing space for cavity insulation. When advanced framing techniques are employed—including insulated headers—the reduction in the amount of framing materials can result in up to 12 percent more insulated space within the exterior wall.

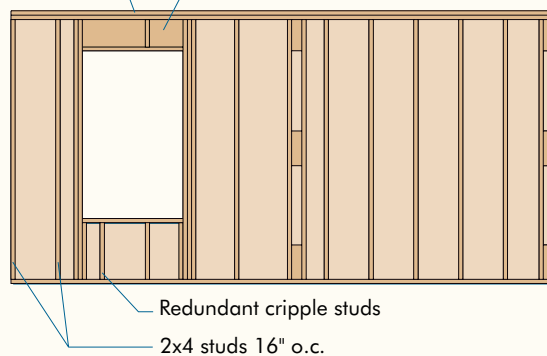
Consult APA’s *Advanced Framing Construction Guide*, Form M400, for further information on advanced framing techniques.

FIGURE 12

### WALL FRAME COMPARISON

#### Conventional Framing

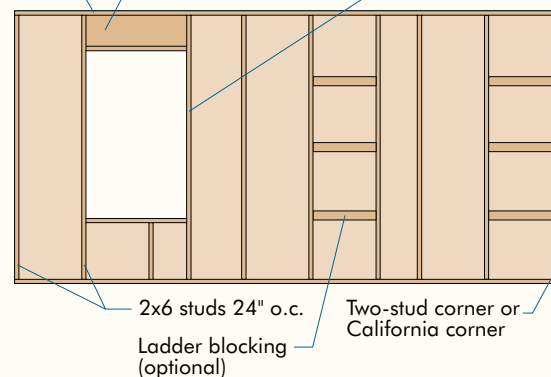
Double top plate  
Single-ply header or other insulated header



a. Advanced framing details can be incorporated individually or as a whole.

#### Advanced Framing<sup>a</sup>

Single top plate  
Single-ply header or other insulated header  
Single studs at sides of opening





### APA Sheathing Under Stucco

Greater stiffness is recommended for wall sheathing when stucco is to be applied. To increase stiffness, apply the long panel dimension or strength axis across studs. Blocking or a plywood cleat is recommended at horizontal joints. Blocking is required for shear wall and wall bracing applications. For panel recommendations applied horizontally or vertically, see Table 24.

### Wood Structural Panel Sheathing as a Nail Base for Siding and Trim

Wood structural panel sheathing provides a withdrawal-resistant nail base for the attachment of exterior wall finishes. Table 25 is a guide for using sheathing as a nail base with lightweight claddings. Popular lightweight cladding products include vinyl, wood, aluminum, fiber cement, APA-Rated lap and panel siding, wood shingles/shakes, and synthetic stucco products. For claddings with weights of 3 psf or less, substituting ring-shank nails for smooth-shank nails allows the same fastener spacing for attachment to continuous wood structural panel sheathing as the siding manufacturer's recommendations for attachment to studs.

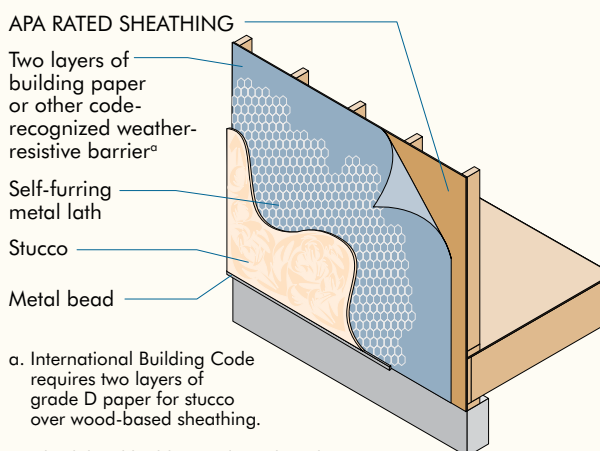
Siding products with weights exceeding 3 psf require additional consideration on fastening directly to sheathing. Consult APA Technical Topics: *Wood Structural Panels Used as Nailable Sheathing*, Form TT-109, for more information, including the withdrawal resistance for a number of different fastener types (smooth-, ring-, and screw-shank nails; wood screws; and vinyl siding nails). Used in combination with the wind load tables R301.2(2) and R301.2(3) from the 2012 and 2015 IRC, the attachment schedules for any combination of siding type, design wind speed, and exposure can be determined using APA Technical Topic TT-109.

The recommendations in Tables 26 and 27 apply to panel and lap siding installed over wood structural panel sheathing. Unless otherwise indicated in the local building code, nailable sheathing includes:

1. Nominal 1-inch boards with studs 16 or 24 inches on center.
2. APA RATED SHEATHING panels with roof Span Rating of 24 inches or greater installed with strength axis either parallel or perpendicular to studs 16 or 24 inches on center (except 3-ply plywood panels must be applied with strength axis across studs when studs are spaced 24 inches on center.)
3. APA RATED SHEATHING panels with roof Span Rating less than 24 inches installed with strength axis either parallel or perpendicular to studs 16 inches on center (except plywood panels 3/8 Performance Category or less must be applied with strength axis across studs).

FIGURE 13

#### STUCCO OVER APA PANEL SHEATHING



a. International Building Code requires two layers of grade D paper for stucco over wood-based sheathing.

Check local building code and applicator for specific requirements.

TABLE 24

#### RECOMMENDED THICKNESS AND SPAN RATING FOR APA PANEL WALL SHEATHING FOR STUCCO EXTERIOR FINISH

Stud Spacing (in.)	Panel Orientation <sup>a</sup>	APA Rated Sheathing <sup>b</sup>	
		Minimum Performance Category	Minimum Span Rating
16	Horizontal <sup>c</sup>	3/8	24/0
	Vertical	7/16 <sup>d</sup>	24/16
		15/32 <sup>e</sup>	32/16
24	Horizontal <sup>c</sup>	7/16	24/16
	Vertical	19/32 <sup>e</sup>	40/20

a. Strength axis (typically the long panel dimension) perpendicular to studs for horizontal application; or parallel to studs for vertical application.

b. Recommendations apply to plywood or oriented strand board (OSB) except as noted.

c. Blocking recommended between studs along horizontal panel joints.

d. Structural I Rated Sheathing (OSB).

e. OSB or 5-ply/5-layer plywood.

TABLE 25

**FASTENER SCHEDULE FOR LIGHTWEIGHT CLADDING WITH CONTINUOUS SHEATHING<sup>a,b,c</sup>**

Fastener Diameter	Fastener Type	Sheathing Performance Category				
		3/8	7/16	15/32	1/2	19/32
Use same diameter as the smooth-shank nail diameter recommended by siding manufacturer	Ring-shank nails <sup>d</sup>	1:1	1:1	1:1	1:1	1:1

- a. The table above is based on the siding manufacturer's installation recommendations for 1.25-inch penetration into spruce-pine-fir lumber framing by smooth-shank nails.
- b. The table above is based on the use of a siding product with a weight of not more than 3 psf.
- c. Additional nails may be required if the siding manufacturer's installation recommendations are based on framing lumber with a specific gravity (SG) greater than 0.42.
- d. Use same number of fasteners and fastener spacing recommended by the siding manufacturer for fastening to studs.

Lap siding joints, if staggered, and panel siding joints may occur away from studs with wood structural panel sheathing.

**Note:** In addition to panel edge spacing and the use of straight studs, nailing sequence can also be a factor in maintaining a uniformly flat appearance of the finished wall. Installation procedure: First, position the panel, maintaining recommended edge spacing, and lightly tack at each corner. Install the first row of nails at the edge next to the preceding panel from top to bottom. Remove remaining tacking nails. Then nail the row at the first intermediate stud. Continue by nailing at the second intermediate stud, and finally, at the edge opposite the preceding panel. Complete the installation by fastening to the top and bottom plates.

### APA Sturd-I-Wall®

The APA Sturd-I-Wall system consists of APA RATED SIDING (panel or lap) applied direct to studs or over nonstructural fiberboard, gypsum or rigid foam insulation sheathing<sup>a</sup>. Nonstructural sheathing is defined as sheathing not recognized by building codes for meeting both bending and racking strength requirements.

A single layer of wood structural panel siding, since it is strong and rack resistant, eliminates the cost of installing separate structural sheathing or diagonal wall bracing. Panel sidings are normally installed vertically, but may also be placed horizontally (long dimension across supports) if horizontal joints are blocked. Maximum stud spacings for both applications are given in Tables 26, 27, 28 and 29.

When installing panel or lap siding over rigid foam insulation sheathing, drive the nails flush with the siding surface, but avoid over-driving, which can result in dimpling of the siding due to the compressible nature of foam sheathing.

Sidings are occasionally treated with water repellents or wood preservatives to improve finishing characteristics or moisture resistance for certain applications. If the siding has been treated, allowing the surface treatment to dry will avoid solvent or chemical reaction with the foam sheathing.

When rigid foam insulation sheathing is used, building codes also generally require installation of 1/2-inch gypsum wallboard, or other materials of the required thermal barrier rating, on the inside surface of the wall for fire protection.

See Figures 14 through 18 for panel and lap siding installation recommendations for the Sturd-I-Wall system or for siding installed over nailable sheathing. See APA's *Build A Better Home: Walls*, Form A530, for additional recommended details to avoid moisture penetration in walls.

a. Where panel siding is applied over foam sheathing, see APA publication *APA Rated Siding Panels over Rigid Foam Insulation Sheathing*, Form C465.

All panel siding edges in Sturd-I-Wall construction should be backed with framing or blocking. Use nonstaining, non-corrosive nails as described in Tables 26, 27, 28 and 29 to prevent staining the siding.

Where siding is to be applied at an angle, install only over wood structural panel sheathing.

**Note:** Gluing of siding to framing is not recommended due to the increased potential for panel buckling.

TABLE 26

**FASTENING APA RATED SIDING (PANEL) APPLIED DIRECT-TO-STUDS OR OVER NONSTRUCTURAL SHEATHING<sup>a,b,c,d,e</sup>**

APA Rated Panel Siding	Minimum Nail <sup>g</sup>		Wall Stud Spacing (in. o.c.)	Panel Nail Spacing		Ultimate Design Wind Speed (mph)		
	Shank Diameter (in.)	Penetration in Framing (in.)		Edges <sup>f</sup> (in. o.c.)	Intermediate Supports (in. o.c.)	Wind Exposure Category		
						B	C	D
3/8			16	6	12	140	115	115
Performance					6	180	155	140
Category APA		1.5	24	6	12	115	NP	NP
MDO GENERAL					6	170	140	130
APA Rated	0.113		16	6	12	160	135	115
Siding 16 oc					6	180	155	145
APA Rated		2.0	24	6	12	130	110	NP
Siding 24 oc					6	180	155	140

a. Table is based on wind pressures acting toward and away from building surfaces, at 30-ft height in wall Zone 5 (corners) with smallest effective area, in accordance with Chapter 30 of ASCE 7-10 and Section R301.2 of the 2015 IRC. Stud specific gravity  $\geq 0.42$ .

b. Recommendations of siding manufacturer may vary.

c. For use as wood structural panel wall bracing, the minimum fastener spacing of 6 inches o.c. at panel edges and 12 inches o.c. at intermediate supports shall be sufficient, except for braced wall section with Performance Category 3/8 panel siding applied horizontally over studs 24 inches o.c., space nails 3 inches o.c. along panel edges.

d. Hot-dip galvanized nails are recommended for most siding applications, see Siding Fasteners section on page 61 for more information.

e. Maximum stud spacing shall be in accordance with Table 28.

f. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 1/2 inch. Fasteners shall be located 3/8 inch from panel edges. Siding installed over two or more spans.

g. See Table 6, page 14, for nail dimensions.

**TYPICAL SIDING TRADEMARKS**

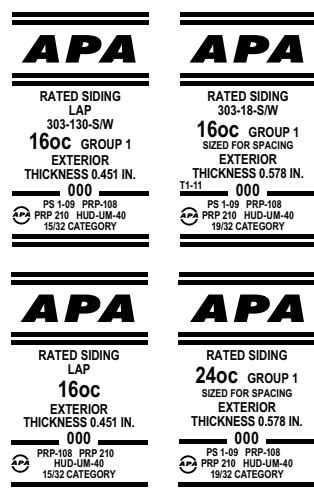


FIGURE 14

**APA STURD-I-WALL (Vertical Panel Installation)**

Building paper or code-recognized weather-resistive barrier required behind siding

APA RATED SIDING panels. All edges supported by framing or blocking. Panel siding meets code requirements for wall bracing.

1/8" spacing is recommended at all edge and end joints unless otherwise indicated by panel manufacturer

6" minimum clearance, siding to grade

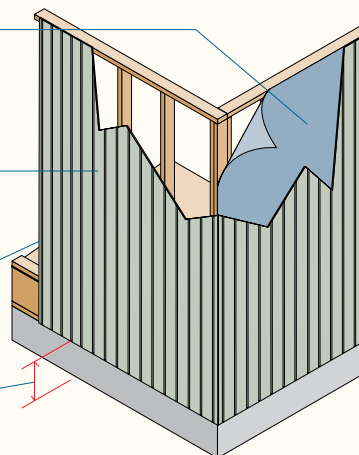


TABLE 27

**APA RATED LAP SIDING APPLIED DIRECT-TO-STUDS OR OVER NONSTRUCTURAL SHEATHING<sup>a,b,c,d,e</sup>**

Minimum Nail <sup>f</sup>		Minimum Performance Category (in.)	Wall Stud Spacing (in. o.c.)	Lap Siding Width (in.)	Ultimate Design Wind Speed (mph)		
Shank Diameter (in.)	Penetration in Framing (in.)				Wind Exposure Category		
0.113	1.5	3/8	16	6	180	155	140
				8	180	155	140
				12	155	130	115
		7/16	16	6	180	155	140
				8	180	155	140
				12	155	130	115
		7/16	24	6	180	155	140
				8	155	130	115
				12	115	NP	NP

- a. Table is based on wind pressures acting toward and away from building surfaces, at 30-ft height in wall Zone 5 (corners) with smallest effective area, per Chapter 30 of ASCE 7-10 and Section R301.2 of the 2015 IRC. Stud specific gravity = 0.42.
- b. Recommendations of siding manufacturer may vary.
- c. APA Rated lap siding rated 16 oc and 24 oc shall be used with a maximum stud spacing of 16 inches o.c. and 24 inches o.c., respectively.
- d. Hot-dip galvanized nails are recommended for most siding applications, see Siding Fasteners section of page 61 for more information.
- e. Single nail at each intermediate stud. Double nail at studs with abutting lap siding. Locate nail 3/8 inch from top of lap siding edge.
- f. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 1/2 inch. Fasteners shall be located 3/8 inch from panel edges. Siding installed over two or more spans.
- g. See Table 6, page 14, for nail dimensions.

FIGURE 15

**APA STURD-I-WALL (Horizontal Lap Siding Installation)<sup>a</sup>**

Building paper or other code-recognized weather-resistive barrier required

Leave 1/8" spacing and caulk vertical joints unless otherwise recommended by siding manufacturer

APA RATED SIDING (lap siding), maximum width 12". Minimum headlap 1".

6" minimum clearance, siding to grade

1-1/2"-wide starter strip, thickness to match lap siding

- a. For engineered shear wall segments or wall bracing requirements, use APA RATED SHEATHING for wall sheathing under lap siding (see Figure 18). Other methods permitted by model building codes for braced wall segments may also be used.

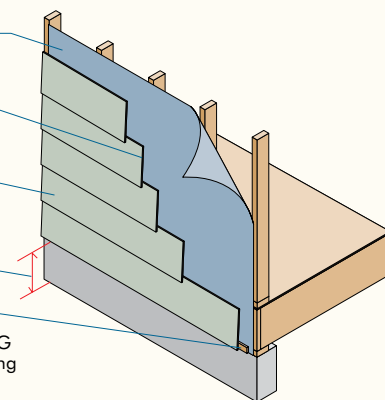


TABLE 28

**MAXIMUM STUD SPACING: APA RATED SIDING (PANEL) APPLIED DIRECT-TO-STUDS OR STRUCTURAL SHEATHING**

Siding Description	Minimum Performance Category or Span Rating	Maximum Stud Spacing (in.) for Vertical Rows of Nails	
		Parallel to Supports	Perpendicular to Supports
APA MDO GENERAL	3/8	16	24
	15/32	24	24
APA Rated Siding	16 oc	16	16 <sup>a</sup>
	24 oc	24	24

- a. Stud spacing may be 24 inches o.c. for veneer-faced siding panels.

## Siding Fasteners

Hot-dip galvanized nails are recommended for most siding applications. For best performance, stainless steel or aluminum nails should be considered. APA tests also show that electrically or mechanically galvanized steel nails appear satisfactory when plating meets or exceeds thickness requirements of ASTM A641 Class 2 coatings, and is further protected by yellow chromate coating. Note that galvanized fasteners may react under wet conditions with the natural extractives of some wood species and may cause staining if left unfinished. Such staining can be minimized if the siding is finished in accordance with APA recommendations, or if the roof overhang protects the siding from direct exposure to moisture and weathering.

FIGURE 16

### APA STURD-I-WALL (Horizontal Panel Siding Installation)

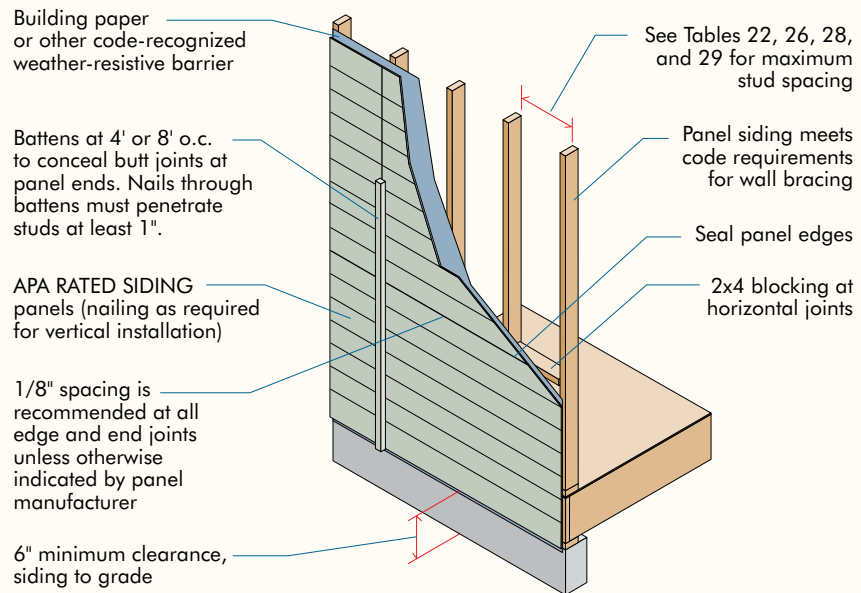


TABLE 29

### APA RATED SIDING (PANEL) APPLIED TO NAIL BASE SHEATHING<sup>a,b,c,d,e</sup>

APA Rated Panel Siding	Minimum Nail <sup>f,g</sup>		Panel Nail Spacing		Ultimate Design Wind Speed (mph)		
	Shank Diameter (in.)	Wall Stud Spacing (in. o.c.)	Edges <sup>h</sup> (in. o.c.)	Intermediate Supports (in. o.c.)	Wind Exposure Category		
					B	C	D
3/8 Performance Category APA MDO GENERAL APA Rated Siding 16 oc or 24 oc	0.120 ring shank	16	6	12	140	115	110
				6	160	135	115
		24	6	12	115	NP	NP
				6	140	90	110

a. Table is based on wind pressures acting toward and away from building surfaces, at 30-ft height in wall Zone 5 (corners) with smallest effective area, per Chapter 30 of ASCE 7-10 and Section R301.2 of the 2015 IRC, stud specific gravity = 0.42.

b. Recommendations of siding manufacturer may vary.

c. For use as wood structural panel wall bracing, the minimum fastener spacing of 6 inches o.c. at panel edges and 12 inches o.c. at intermediate supports shall be sufficient.

d. Hot-dip galvanized nails are recommended for most siding applications, see Siding Fasteners section on page 61 for more information.

e. Maximum stud spacing shall be in accordance with Table 28.

f. Ring-shank nail shall be used.

g. See Table 6, page 14, for nail dimensions.

h. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 1/2 inch. Fasteners shall be located 3/8 inch from panel edges.

FIGURE 17

**APA RATED PANEL SIDING OVER WOOD STRUCTURAL PANEL SHEATHING**

Building paper or other code-recognized weather-resistive barrier required

APA RATED SIDING panels applied over sheathing

6" minimum clearance, siding to grade

1/8" spacing is recommended at all edge and end joints unless otherwise indicated by panel manufacturer

Panel siding or APA RATED SHEATHING meets code requirement for wall bracing

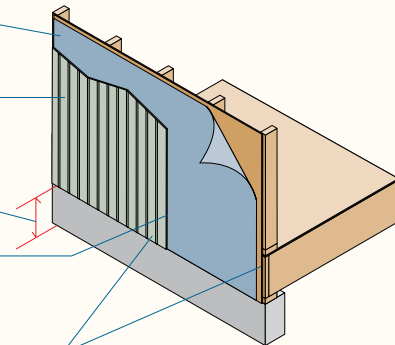


TABLE 30

**APA RATED LAP SIDING APPLIED DIRECTLY TO STUDS OR TO NAIL BASE SHEATHING<sup>a,b,c</sup>**

Minimum Nail Shank Diameter <sup>d</sup> (in.)	Minimum Performance Category Lap Siding	Fastener Spacing (in.) <sup>e</sup>	Lap Siding Width (in.)	Ultimate Design Wind Speed (mph)		
				Wind Exposure Category		
				B	C	D
0.113	3/8	6	6	170	140	130
			8	140	115	110
			12	110	NP	NP

a. Table is based on wind pressures acting toward and away from building surfaces, at 30-ft height in wall Zone 5 (corners) with smallest effective area, per Chapter 30 of ASCE 7-10 and Section R301.2 of the 2015 IRC, stud specific gravity = 0.42.

b. Recommendations of siding manufacturer may vary.

c. Hot-dip galvanized nails are recommended for most siding applications, see Siding Fasteners section on page 61 for more information.

d. See Table 6, page 14, for nail dimensions.

e. Fastener spacing at top edge of lap siding.

FIGURE 18

**APA RATED LAP SIDING OVER WOOD STRUCTURAL PANEL SHEATHING**

APA RATED SHEATHING meets code requirement for wall bracing

Building paper or other code-recognized weather-resistive barrier required

APA RATED SIDING (lap siding), maximum width 12". Minimum headlap 1".

Siding joints, if staggered, may occur away from studs with nailable sheathing

6" minimum clearance, siding to grade

Leave 1/8" spacing and caulk vertical joints, unless otherwise recommended by siding manufacturer

1-1/2"-wide starter strip, thickness to match lap siding

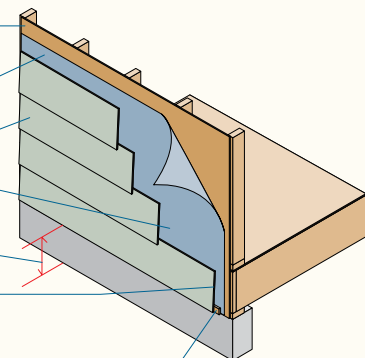
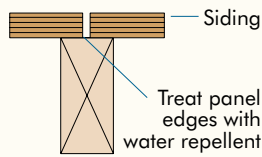




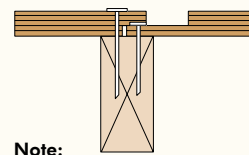
FIGURE 19

**TYPICAL PANEL SIDING JOINT DETAILS**

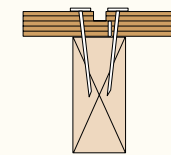
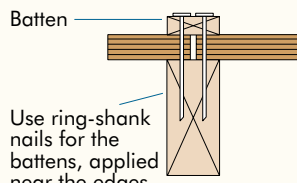
**Note:** Water-resistive barrier (building paper or house wrap omitted from figure for clarity) is required behind siding.

**VERTICAL WALL JOINTS****Butt****Shiplap**

Reverse Board and Batten



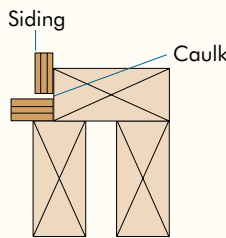
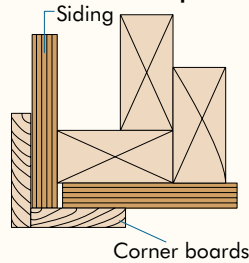
T1-11 &amp; Channel Groove

**Vertical Batten**

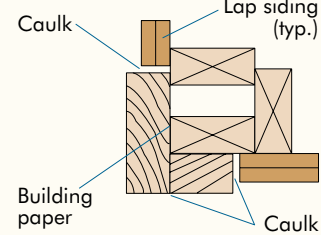
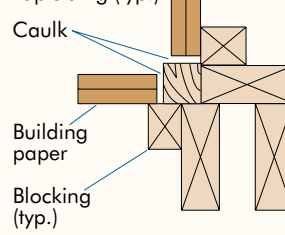
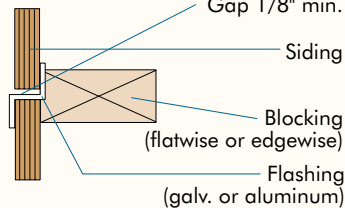
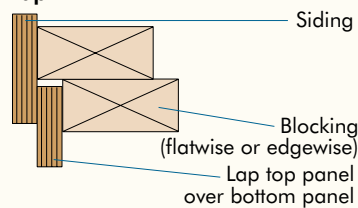
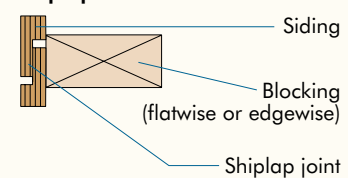
Use ring-shank nails for the battens, applied near the edges in two staggered rows

**Note:**

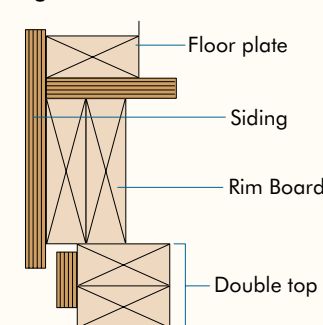
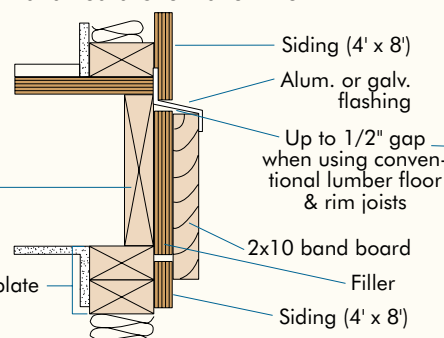
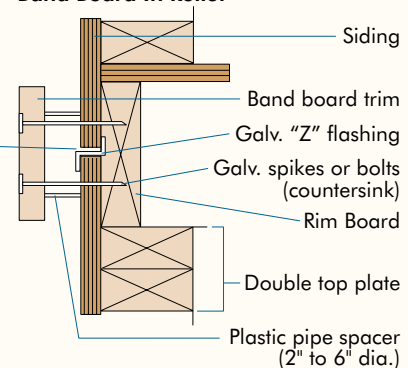
Nailing of both panel edges along shiplap joint is recommended. The "double nailing" is required when wall segment must meet wall bracing or engineered shear wall requirements.

**VERTICAL INSIDE & OUTSIDE CORNER JOINTS****Butt & Caulk****Corner Board Lap Joints****Lap Siding (APA Sturd-I-Wall)**

Lap siding (typ.)

**HORIZONTAL WALL JOINTS****Butt & Flash****Lap****Shiplap****HORIZONTAL BELTLINE JOINTS**

(For multistory buildings, when conventional lumber floor joists and rim boards are used, make provisions at horizontal joints for shrinkage of framing, especially when applying siding direct to studs.)

**Jog Exterior Stud Line****Band Board Over Panel Filler****Band Board In Relief****WINDOW DETAILS**

(For window details, see *Build A Better Home: Walls*, Form A530.)

## Siding Joint Details

The siding joint details in Figure 19 are based on the use of APA trademarked siding. Nailing of wood structural panel siding along both edges of shiplap joints (“double nailing”), as shown, is required for shear walls or those wall segments that must meet bracing requirements. Double nailing is recommended for all other applications as well to provide maximum wall strength and moisture protection.

Where caulks or joint sealants are indicated, consider the various types available such as urethane, plasticized acrylic latex, butyl and polysulfide. Check with the manufacturer of the caulk or sealant to determine suitability for the intended application and compatibility with coatings and other building materials such as vinyl and aluminum.

In some cases, a foam backer rod or other type filler material may be used behind the sealants as recommended by the manufacturer. For best results in other cases, apply caulking to framing at panel edges before installing the siding panel; or apply a bead of caulk along the panel edge before installing the next panel. A 1/8-inch space is recommended at all edge and end joints unless otherwise indicated by panel manufacturer. If caulk is to be used, also check with caulk manufacturer for recommended edge spacing. Nails through battens or other wood trim must penetrate at least 1 inch into studs. Nail panel siding 6 inches o.c. along edges and 12 inches o.c. at intermediate supports. To prevent staining of siding, use hot-dip galvanized, aluminum, or other nonstaining nails as described on page 61.

Siding is often fully exposed to weather and thus has increased susceptibility to elevated moisture conditions. Although siding will periodically experience moisture contents above the threshold value needed to support decay, wood-based siding products have a good history of performance because they dry below this threshold value before decay can initiate. If trim is installed around siding, be sure that it doesn’t trap moisture or reduce the drying ability of the wood. Trim that is applied incorrectly can lead to long-term moisture accumulation that causes decay.

Apply flashing or other means of protection over end grain of siding to minimize water absorption.

## APA Rated Siding Patterns and Grades

APA RATED SIDING, including 303 plywood siding, is available in a wide variety of surface textures and patterns. For descriptions of siding surface patterns and thicknesses, refer to *APA Product Guide: Performance Rated Siding*, Form E300. Actual dimensions of groove spacing, width and depth may vary with the manufacturer. Where the characteristics of a particular wood species are desired, specify by grade and species preference.

In order to help specifiers select the most appropriate siding appearance for any particular job, APA 303 plywood sidings are also identified

TABLE 31

### APA 303 SIDING FACE GRADES<sup>a</sup>

303 Series Plywood Siding Grades	Type of Patch	
	Wood	Synthetic
303-OC	Not permitted	Not permitted
303-OL	Not applicable for overlays	
303-NR	Not permitted	Not permitted
303-SR	Not permitted	Permitted as natural-defect shape
303-6-W	Limit 6	Not permitted
303-6-S	Not permitted	Limit 6
303-6-S/W	Limit 6—any combination	
303-18-W	Limit 18	Not permitted
303-18-S	Not permitted	Limit 18
303-18-S/W	Limit 18—any combination	
303-30-W	Limit 30	Not permitted
303-30-S	Not permitted	Limit 30
303-30-S/W	Limit 30—any combination	

a. All panels except 303-NR allow restricted minor repairs such as shims. These other face appearance characteristics as knots, knotholes, splits, etc., are limited by both size and number in accordance with panel grades, 303-OC being most restrictive and 303-30 being least. Multiple repairs are permitted only on 303-18 and 303-30 panels. Patch size is restricted on all panel grades.

by a face grading system. There are four basic siding classifications within the system—Special Series 303, 303-6, 303-18 and 303-30. Each class, as shown in Table 31, is further divided into grades according to categories of repair and appearance characteristics.

## Finishing Plywood for Exterior Exposure

### Care and Preparation

Plywood should be stored and handled with care to avoid damaging before finishing. Storage in a cool, dry place out of sunlight and weather is best. If left outdoors, straps on bundles should be loosened or cut and the plywood covered. Allow good air circulation to prevent moisture condensation and possible mold growth.

### Edge Sealing

Moisture enters the end grain of plywood or other wood-based products faster than through the surface. Consequently, edges and ends of APA RATED SIDING panels or lap siding should be sealed. Although edge sealers are not necessarily moisture-proof or permanently durable, they help to minimize sudden changes in moisture content in the siding, due to weather.

APA RATED SIDING may be edge-sealed at the factory. If the siding is not factory-sealed, it can be sealed quickly at the job site while the panels or lap siding pieces are still in a stack. Edges or ends cut during construction should be resealed.

Siding to be finished with a semitransparent or solid-color stain can be edge-sealed with a liberal application of a paintable, water-repellent sealer. If the siding is to be painted, apply sealer to edges using the same paint primer that will be used on the surface. Horizontal edges, particularly lower drip edges of siding, should be carefully edge-sealed because of their greater wetting exposure.

### Finishing

APA RATED SIDING may be finished with a variety of products such as semitransparent stains, solid-color stains or paint systems. The recommended finishes depend on the type of siding product, and whether it has an overlaid surface.

Oil-based, semitransparent stains may be used on certain veneer-faced siding products as detailed in Table 32. Solid-color stains may be used on most APA RATED SIDING products and usually provide better protection. In general, however, best overall performance on APA RATED SIDING products can be achieved with an all-acrylic latex paint system.

TABLE 32

**APA 303 SIDING FINISHING RECOMMENDATIONS**

303 Series Plywood Siding Grades	Stains		Paints
	Semitransparent (oil)	Solid Color (oil or latex) <sup>a</sup>	Minimum 1 primer plus 1 topcoat (acrylic latex)
303-OC	b	b	b
303-OL	Not Recommended	d	b
303-NR	b	e	e
303-SR	c	e	e
303-6-W	b	b	b
303-6-S	c	b	b
303-6-S/W	c	b	b
303-18-W	c	b	b
303-18-S	c	b	b
303-18-S/W	c	b	b
303-30-W	c	b	b
303-30-S	c	b	b
303-30-S/W	c	b	b

- Except for overlaid panels, use a stain-resistant primer with light-colored latex stains, since the wood extractives may cause a discoloration of the finish.
- Recommended with provisions given in text.
- Should not be finished with semitransparent stain unless specifically recommended by the panel manufacturer.
- Some panel manufacturers recommend only acrylic latex formulations. Consult the manufacturer's recommendations.
- Only acrylic latex formulations are recommended when solid-color stains or paint systems are applied over open voids.

For overlaid siding, any top-quality exterior house paint system formulated for wood performs satisfactorily. Solid-color stains may also be used on overlaid sidings, although some manufacturers recommend only acrylic latex formulations. For specific recommendations on finishing OSB siding products, consult the siding manufacturer.

Table 32 provides a summary of finishing recommendations for APA 303 Siding face grades. For complete information, refer to *APA Product Guide: Performance Rated Siding*, Form E300.

### **Semitransparent Stains (oil-based only)**

Oil-based semitransparent stains emphasize grain patterns, texture and natural characteristics in the wood. They may be used on plywood face grades 303-OC, 303-NR and 303-6-W. It is the only finish recommended for use over brushed plywood. Other 303 face grades should not be finished with semitransparent stains unless specifically recommended by the panel manufacturer.

### **Solid-Color Stains (oil or all-acrylic latex)**

An opaque or solid-color stain obscures color differences in the wood and between repairs and surrounding wood. This is often a satisfactory finishing system, therefore, where semitransparent stains are unsuitable. Wood grain is also muted with solid-color stains, but wood surface textures usually remain evident. When in question, the finish should be applied to a representative sample in order to demonstrate the finished appearance.

Solid-color stains are particularly recommended for grades 303-6-S and 303-6-S/W, as well as 303-18 and 303-30 with any type of patch.

### **Paints (all-acrylic latex)**

Top-quality acrylic latex house paint systems are recommended for all APA Rated Sidings, except brushed plywood. If house paint is used on plywood siding, an all-acrylic latex paint system consisting of at least one stain-blocking prime coat and an all-acrylic latex topcoat is recommended. For extractive staining woods, some house paint systems utilize an oil-alkyd primer. Others use up to two coats of a stain-blocking acrylic latex primer. These latter systems help to reduce face-checking and generally offer superior performance. A paint finish tends to mask the textured plywood surface more than either semitransparent or solid-color stains. On the other hand, a top-quality acrylic latex paint system provides the most durable finish.

Grade 303-OL may be finished with any top-quality exterior paint system—primer and companion topcoat—formulated for wood.

### **Field Application of Finish**

Proper surface preparation is important for good performance of finishes on any surface. Remove dirt and loose wood fibers with a stiff nonmetallic bristle brush. Mildew may be removed with a solution of 1/4 part household bleach to 3/4 part warm water. Be sure to rinse thoroughly after application of bleach.

Finishes should be applied as soon as possible after installation of the siding. Weathering of unprotected wood can cause surface damage in as little as two to four weeks. Apply finishes during favorable weather conditions. As a rule of thumb, finishes should not be applied when the outside air temperature is expected to drop below 50° F within 24 hours for latex finishes, or 40° F for oil-based finishes. However, recommendations of individual manufacturers may vary and should always be followed. Wood surfaces should be clean and dry, although extremely dry surfaces should be dampened slightly when applying latex finishes.

Use only top-quality finishes and application equipment. Finishes should be applied according to the spread rates recommended by the manufacturer. Textured surfaces may require up to twice as much finish as smooth surfaces. The first coat should be applied by brush. If spray equipment is used to apply the finish, then the finish should be either back-brushed or back-rolled while it is still wet. Subsequent coats of finish may be applied by any conventional means.

## Interior Paneling

APA Rated Siding panels lend themselves to a number of decorative surface treatments for attractive interior paneling and accent walls. (See Figures 20 and 21.) Such treatments include saw-textured, brushed, embossed and grooved. Let APA panels acclimatize to room temperature and humidity conditions for several days prior to attachment to the wall. This can be accomplished by placing the panels on edge with space between each panel to allow air to circulate freely over both sides. Preservative treatment of furring or studs is recommended when they are attached to masonry or concrete exterior walls and to any uncured concrete wall. Also, in these instances, install a 4-mil polyethylene vapor retarder between the paneling and the furring or studs and insulated exterior walls. Support and nail spacing recommendations are given in Table 33. Recommendations apply to all species groups.

TABLE 33

### INTERIOR PANELING

Panel Performance Category	Maximum Support Spacing (in.)	Nail Size (Use casing or finishing nails) <sup>c</sup>	Maximum Nail Spacing (in.)	
			Panel Edges	Intermediate Supports
1/4	16 <sup>a</sup>	4d	6	12
5/16	16 <sup>b</sup>	6d	6	12
11/32 – 1/2	24	6d	6	12
19/32 – 3/4	24	8d	6	12
Texture 1-11	24	8d	6	12

a. Can be 20 inches if strength axis of paneling is across supports.

b. Can be 24 inches if strength axis of paneling is across supports.

c. See Table 6, page 14, for nail dimensions.

## Panel Backing

Wood structural panels are excellent backing for wall coverings such as rare hardwoods, vinyl surfaces and decorative fabrics. Panels with Performance Categories smaller than 15/32 should be applied with strength axis perpendicular to studs and with 2x4 blocking at horizontal edges. Thicker panels may be applied with strength axis parallel to studs. For thin coverings subject to telegraphing of underlying surface texture, only sanded plywood is recommended. Plywood panels should have C-Plugged or better faces. Use 6d nails spaced 6 inches on center at panel edges and 12 inches on center at intermediate supports. A 1/16-inch space should be left between panels. Where moisture may be present, use nonstaining nails and either Exposure 1 or Exterior type panels. A 1/4-inch clearance is recommended at the bottom edge of the panels.

FIGURE 20

### PANELING NEW INTERIOR WALLS

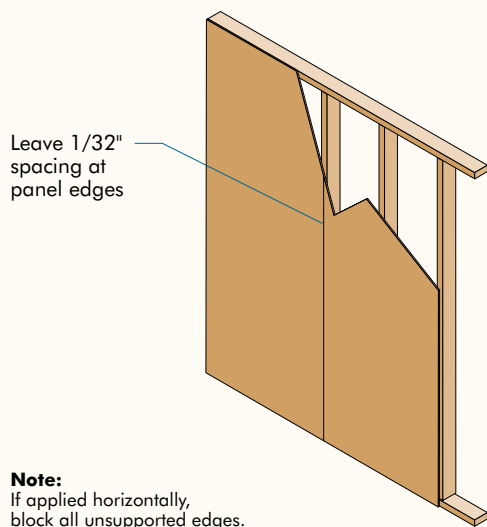
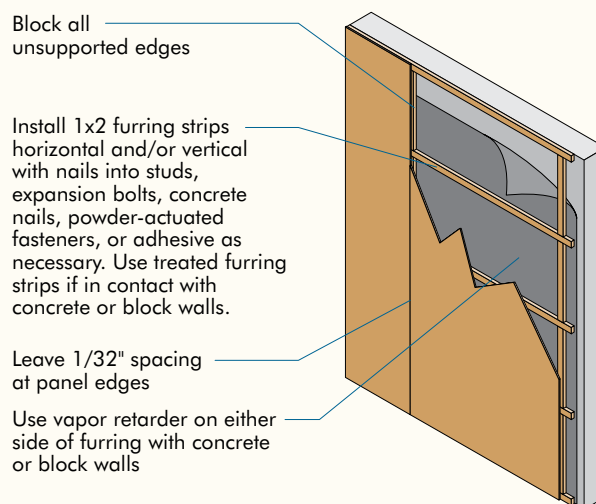


FIGURE 21

### PANELING EXISTING INTERIOR WALLS



## Wall Construction

We have field representatives in many major U.S. cities and in Canada who can help answer questions involving APA trademarked products. For additional assistance in specifying engineered wood products, contact us:

### APA HEADQUARTERS

7011 So. 19th St. ■ Tacoma, Washington 98466  
(253) 565-6600 ■ Fax: (253) 565-7265

### PRODUCT SUPPORT HELP DESK

(253) 620-7400 ■ [help@apawood.org](mailto:help@apawood.org)

### DISCLAIMER

*The information contained herein is based on APA – The Engineered Wood Association’s continuing programs of laboratory testing, product research, and comprehensive field experience. Neither APA, nor its members make any warranty, expressed or implied, or assume any legal liability or responsibility for the use, application of, and/or reference to opinions, findings, conclusions, or recommendations included in this publication. Consult your local jurisdiction or design professional to assure compliance with code, construction, and performance requirements. Because APA has no control over quality of workmanship or the conditions under which engineered wood products are used, it cannot accept responsibility for product performance or designs as actually constructed.*

Excerpted from E30W/Revised February 2016



REPRESENTING THE ENGINEERED WOOD INDUSTRY

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