Engineered Wood Wall Systems

CONSTRUCTION GUIDE

LIMIT STATES DESIGN FOR USE IN CANADA

Engineered Wood for 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 publication provides an overview of several commonly used wall systems and shows details on how wood structural panels can be used to meet fundamental requirements in wall applications.

METRIC CONVERSIONS

Panel thicknesses indicated in this document are in metric as the primary units and represent the nominal panel thickness. Support and fastener spacing in this document follows common construction practice in Canada and is based on Imperial measurements. "Nominal" or rounded values have been used to indicate the metric equivalents for support and fastener spacing. Actual measurements for support spacing are listed below. The nominal metric equivalents of the Imperial measurements are shown in text, figures and tables in this document.

METRIC CONVERSIONS

Nominal Support Spacing, mm	Actual Support Spacing, mm (inches)
400	406 (16)
500	488 (19.2)
600	610 (24)
800	813 (32)
1200	1219 (48)

PANEL PERFORMANCE CATEGORIES

Imperial	Metric (mm) Nominal	Span Rating (CSA O325)
3/8	9.5	2R24, W24
7/16	11	1R24/2F16
15/32	12	2R32/2F16
1/2	12.5	
19/32	15	2R40/2F20, 1F16, 1F20
5/8	15.5	
23/32	18	2R48/2F24, 1F24
3/4	18.5	
13/16	20.5	
7/8	22	1F32
1	25	
1 1/8	28.5	1F48

WALL CONSTRUCTION

Continuously Sheathed Wood Walls

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 the National Building Code of Canada (NBC) 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 Rated Sheathing for Wall Applications

APA RATED SHEATHING is a structural panel made of plywood or oriented strand board (OSB). The plywood sheathing is manufactured for conformance to CSA O121 for Douglas Fir Plywood (DFP) and CSA O151 for Canadian Softwood Plywood (CSP), while the OSB sheathing is manufactured for conformance to CSA O325, as required by the NBC and CSA O86, *Engineering Design in Wood*. Table W1 shows the panel mark, thickness and fastener requirements for APA RATED SHEATHING in wall applications.

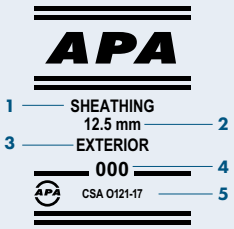
APA RATED SHEATHING meets the NBC requirements for wall bracing (Figures W1 and W2). Continuous wood structural panel wall bracing provides the greatest flexibility when bracing walls with window and door openings. It is most commonly used directly under siding but can also be used in combination with continuous insulated sheathing.

Recommended wall sheathing with brick veneer or masonry is the same as those for panel sheathing (see Table W1). See Figure W3 for installation recommendations. Panel recommendations for panelized wall sections are the same as for built-in-place walls.

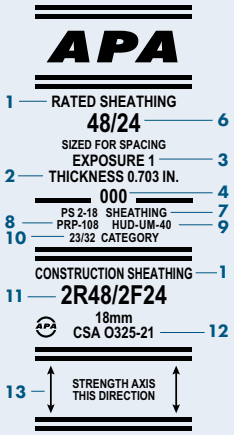
Note: To minimize the potential for panel buckling, gluing of wall sheathing to framing is not recommended, except when recommended by the adhesive manufacturer for wall sheathing that already has been permanently protected by siding. Check with the local jurisdiction for the use of adhesive attachment of shear wall sheathing in high seismic zones.

TYPICAL APA PANEL TRADEMARKS

PLYWOOD TRADEMARK



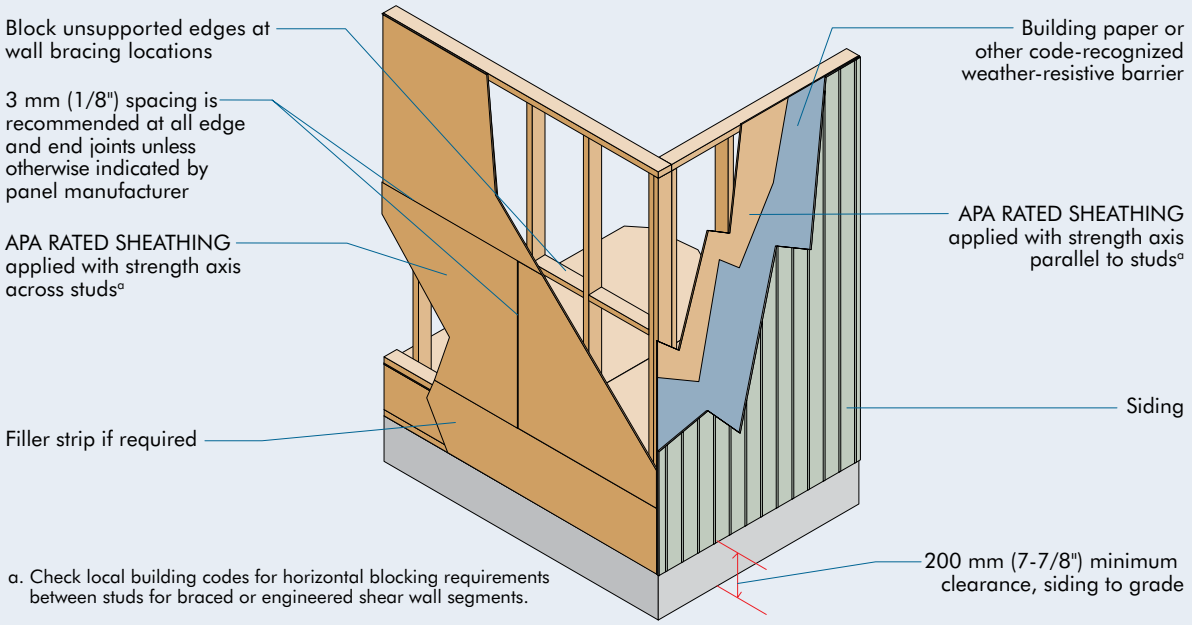
OSB TRADEMARK



1. Panel Grade
2. Nominal Panel Thickness (Optional for standard panel thicknesses)
3. Bond Classification
4. Mill Number
5. Canadian Plywood Standard
6. Span Rating (U.S. Format)
7. Product Standard and Grade
8. APA's Performance Rated Panel Standard
9. HUD Recognition
10. Performance Category
11. Panel Mark — Rating and End-Use Designation in Accordance with CSA O325
12. Canadian OSB Standard
13. Panel Face Orientation Indicator

FIGURE W1

APA PANEL WALL SHEATHING



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

FIGURE W2

WALL BRACING

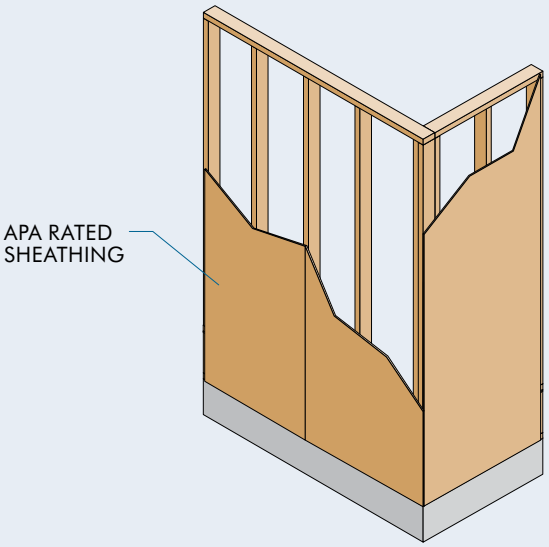
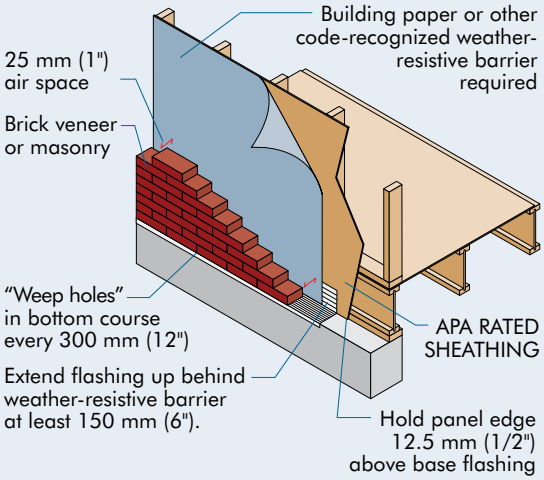


FIGURE W3

BRICK VENEER OVER APA PANEL SHEATHING



a. For brick veneer tie attachment to APA panel sheathing, see *Nail-Base Sheathing for Siding and Trim Attachment*, Form Q250.

The edges of sheathing in a ***braced wall panel*** shall be supported and fastened to wood blocking where the braced wall panel supports more than a roof of lightweight construction (NBC Section 9.23.3.5(8)), or the seismic spectral response acceleration, $S_a(0.2)$, is greater than 1.2.

TABLE W1

APA RATED PANEL MARK, PANEL THICKNESS AND FASTENERS REQUIREMENTS[a,b]

CSA Panel Mark	APA Panel Mark	Minimum Panel Thickness	Minimum Length of Fasteners (Common or Spiral Nails)	Maximum Fasteners Spacing	
				Supported Panel Edges	Intermediate Supports
1-in-50 HWP < 0.8 kPa (16.7 psf) and $S_a(0.2) \leq 0.70$[c] – braced wall panels not required					
DFP (Douglas Fir Plywood), CSA O121	APA RATED SHEATHING Exterior Plywood, CSA O121	7.5 mm (19/64")	51 mm (2")	150 mm (6")	300 mm (12")
CSP (Canadian Softwood Plywood), CSA O151	APA RATED SHEATHING Exterior Plywood, CSA O151				
OSB, CSA O325	APA RATED SHEATHING Exposure 1, CSA O325				
0.8 kPa (16.7 psf) ≤ 1-in-50 HWP < 1.2 kPa (25 psf) and $S_a(0.2) \leq 0.9$, or $0.70 < S_a(0.2) \leq 0.90$[c,d,e] – braced wall panels required					
DFP (Douglas Fir Plywood), CSA O121	APA RATED SHEATHING Exterior Plywood, CSA O121	11 mm (7/16") with supports at 400 mm (16") or 12.5 mm (1/2") with supports at 600 mm (24")	63 mm (2-1/2")	150 mm (6")	300 mm (12")
CSP (Canadian Softwood Plywood), CSA O151	APA RATED SHEATHING Exterior Plywood, CSA O151				
OSB, CSA O325	APA RATED SHEATHING Exposure 1, CSA O325				
0.8 kPa (16.7 psf) ≤ 1-in-50 HWP < 1.2 kPa (25 psf) and $S_a(0.2) \leq 1.8$, or $0.90 < S_a(0.2) \leq 1.8$[c,d,e] – braced wall panels required					
DFP (Douglas Fir Plywood), CSA O121	APA RATED SHEATHING Exterior Plywood, CSA O121	11 mm (7/16") with supports at 400 mm (16") or 12.5 mm (1/2") with supports at 600 mm (24")	63 mm (2-1/2")	75 mm (3")	300 mm (12")
CSP (Canadian Softwood Plywood), CSA O151	APA RATED SHEATHING Exterior Plywood, CSA O151				
OSB, CSA O325	APA RATED SHEATHING Exposure 1, CSA O325				
1-in-50 HWP ≥ 1.2 kPa (25 psf) or $S_a(0.2) > 1.8$ – bracing and design in accordance with NBC Part 4[c,f]					

Notes:

a. Fastening and sheathing requirements are in accordance with Part 9 of NBC Table 9.23.3.5 – A, B, C, Table 9.23.13.6 (for braced wall panels), and Section 9.23.17 where braced wall panels are not required.

b. Fasteners shall comply with CSA B111 or ASTM F1667. Other code-approved fasteners with equivalent capacities are also allowed.

c. Bracing requirements should be in accordance with Table W3 of this document.

d. Fasteners required for braced wall panels: Minimum length is 63 mm (2-1/2 in.); minimum diameter is 3.25 mm (0.128 in.) in accordance with NBC Table 9.23.3.1.

e. Minimum panel thickness for braced wall panels should be in accordance with Table W4 of this document.

f. Where 1-in-50 Hourly Wind Pressure (HWP) ≥ 1.2 kPa (25 psf) or seismic spectral response acceleration $S_a(0.2) > 1.8$, the fastening and sheathing shall conform to NBC Part 4.

Nail sizes referenced through this document can be found in Table W2.

TABLE W2

NAIL SIZES[a,b] (ASTM F1667)

Nail Pennyweight	Type	Nail Length	Nail Diameter
6d	Common	51 mm (2")	2.87 mm (0.113")
8d	Common	63 mm (2-1/2")	3.33 mm (0.131")
10d	Common	76 mm (3")	3.76 mm (0.148")

Notes:

a. Fasteners comply with the NBC and CSA O86 requirements.

b. Fasteners shall be firmly driven into the framing members but shall not be over-driven into sheathing more than 15% of the panel thickness (CSA O86-19 Section 11.3.2.3).

Wood Structural Panel Wall Bracing and Shear Walls

Wood structural braced wall panels and shear walls are used to resist racking forces caused by lateral loads from wind or seismic events. While braced wall panels and shear walls serve the same purpose, they have distinct differences, as explained below.

Wall Bracing

Braced wall panels in braced wall bands are typically a part of conventional prescriptive construction as found in NBC Sections 9.23.13.4 to 9.23.13.7. Wall bracing is prescribed in a how-to format, and braced walls generally do not require hold-down devices or tight fastener schedules. Usually, there is no engineering required when using prescriptive wall bracing. For structures or portions of walls that do not meet the prescriptive construction parameters in accordance with NBC Sections 9.23.13.1 to 9.23.13.3, braced wall panels or engineered design in accordance with NBC Part 4 are required. Table W3 of this document indicates where braced wall panels or engineered design are required based on the construction type, the 1-in-50 Hourly Wind Pressure (HWP) and the Seismic Spectral Response (S_a).

TABLE W3

BRACING REQUIREMENTS[a,b,c]

1-in-50 Hourly Wind Pressure (HWP)			Seismic Spectral Response Acceleration, $S_a(0.2)$		
Low to Moderate	**High**	**Extreme**	**Low to Moderate**	**High**	**Extreme**
HWP < 0.80 kPa (16.7 psf)	**0.8 kPa (16.7 psf) ≤ HWP < 1.20 kPa (25 psf)**	**HWP ≥ 1.20 kPa (25 psf)**	**$S_a(0.2) \leq 0.70$**	**$0.70 < S_a(0.2) \leq 1.8$**	**$S_a(0.2) > 1.8$**
NBC 9.23.13.1: 1. Clad with panel-type cladding in accordance with NBC 9.27. 2. Sheathed with plywood, OSB, complying with NBC 9.23.17 and fastened in accordance with Table W1 of this guide. 3. Finished on the interior with a panel-type material in accordance with the requirements of NBC 9.29, or Table W1 of this guide.	Braced Wall Bands and Braced Wall Panels in accordance with NBC 9.23.13.4 to 9.23.13.7	NBC Part 4 (engineered design)	NBC 9.23.13.1: 1. Clad with panel-type cladding in accordance with NBC 9.27. 2. Sheathed with plywood, OSB, complying with NBC 9.23.17 and fastened in accordance with Table W1 of this guide. 3. Finished on the interior with a panel-type material in accordance with the requirements of NBC 9.29 or Table W1 of this guide.	1. Lowest exterior wall does not support more than 2 floors in light construction[d] or 1 floor in heavy construction[e] 2. Braced Wall Bands and Braced Wall Panels in accordance with NBC 9.23.13.4 to 9.23.13.7	1. Lowest exterior wall supports more than 2 floors in light construction[d] or 1 floor in heavy construction[e] 2. Part 4 of the NBC (engineered design)

Notes:

a. Bracing requirements in accordance with NBC Table A-9.23.13.

b. Braced wall panels shall be located withing braced wall bands and comply with NBC Sections 9.23.13.5, 9.23.13.6 and 9.23.13.7.

c. Braced wall bands shall be full storey height, not more than 1.2 m (4 ft) wide, lapped at both ends with another braced wall band, aligned with braced wall bands on storey above and below, and conform with the spacing and dimensions provided in NBC Section 9.23.13.4 and Table 9.23.13.5

d. Light construction refers to stucco walls or walls that are clad with directly applied heavyweight materials where the vertical average weight/dead load < 0.32 kPa (6 psf).

e. Heavy construction refers to stucco walls or walls that are clad with directly applied heavyweight materials where the vertical average weight/dead load ≥ 0.32 to 1.2 kPa (6 to 25 psf).

According to NBC Section 9.23.13.6, braced wall panels (where required) shall be clad with panel-type cladding and sheathed with APA RATED SHEATHING complying with Table W4 and finished on the interior with panel-type material in accordance with the requirements of NBC Section 9.29. Interior braced wall panels shall be sheathed or finished on both sides with a wood-based material or finished on both sides with gypsum board. Interior braced wall panels may be sheathed on one side only, provided that the sheathing material is an APA RATED SHEATHING as defined in Table W1 and the nail spacing along the edge is 75 mm (3 inches) or less.

TABLE W4

MINIMUM THICKNESS OF APA RATED SHEATHING USED FOR CLADDING, SHEATHING OR INTERIOR FINISH FOR BRACED WALL PANELS[a,b]

Panel-Type Cladding, Sheathing or Interior Finish	Minimum Span-Rating or Panel Thickness			
	Where $S_a(0.2) \leq 0.90$		Where $S_a(0.2) > 0.90$	
	With supports 400 mm (16") o.c.	With supports 600 mm (24") o.c.	With supports 400 mm (16") o.c.	With supports 600 mm (24") o.c.
APA RATED SHEATHING Exterior Plywood complying with CSA O121 (DFP) or CSA O151 (CSP)	11 mm (7/16")	12.5 (1/2")	11 mm (7/16")	12.5 (1/2")
APA RATED SHEATHING Exposure 1 OSB complying with CSA O325	W16[b], W24 or 2R24	W24 or 2R24	W16[b], W24 or 2R24	W24 or 2R24

Notes:

a. Minimum thickness for braced wall panels in accordance with NBC Table 9.23.13.6.

b. W16 is not commonly available.

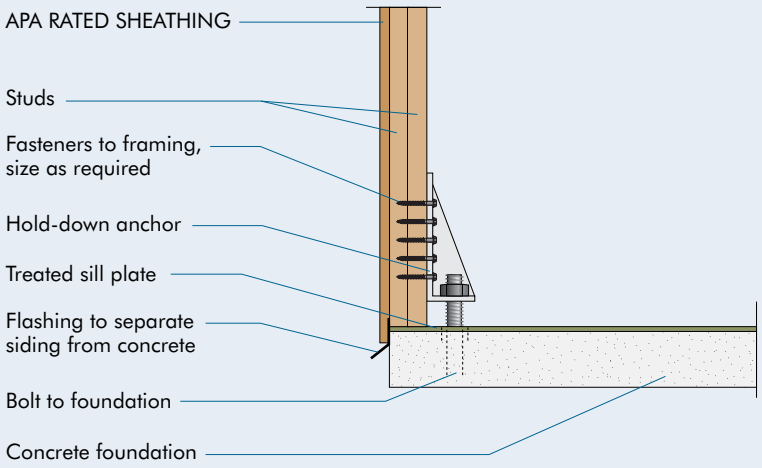
Shear Walls

The engineered version of wall bracing is a shear wall. Shear walls are designed by an engineer to resist the specific lateral 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 W5 shows the factored shear resistance values for single-side-sheathed wood structural panel shear walls with SPF and DF framing. Shear walls are also permitted to be designed to account for openings and with both sides of the wall sheathed with wood structural panel sheathing. They usually require hold-downs to resist overturning of wall segments, as specified in the CSA O86 Sections 11.4.4, 11.4.5 and 11.4.6, as shown in Figure W4.

FIGURE W4

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.



APA RATED SHEATHING can be used in shear wall design, and the data presented here indicate the maximum factored shear resistance for walls with APA RATED SHEATHING and with panels applied over gypsum sheathing for walls required to be fire-rated from the outside.

TABLE W5

FACTORED SHEAR RESISTANCE[a,b,c,d] FOR APA PANEL SHEAR WALLS[e,f,g,h,i]

Panel Type Or Span Rating	Minimum Nominal Panel Thickness	Min. Nail Penetration in Framing	Nail Size (Common)	BLOCKED SHEAR WALLS – PANEL DIRECTLY APPLIED TO SPF FRAMING Factored Shear Resistance, kN/m (lbf/ft) for Nail Spacing at Panel Edges of				BLOCKED SHEAR WALLS – PANEL DIRECTLY APPLIED TO DFP FRAMING Factored Shear Resistance, kN/m (lbf/ft) for Nail Spacing at Panel Edges of			
				150 mm (6")	100 mm (4")	75 mm (3")	50 mm (2")	150 mm (6")	100 mm (4")	75 mm (3")	50 mm (2")
DFP/CSP Plywood	7.5 mm (19/64")	32 mm (1-1/4")	6d	3.81 (260)	5.22 (357)	5.22 (357)	5.22 (357)	4.05 (277)	5.22 (357)	5.22 (357)	5.22 (357)
	9.5 mm (3/8")		8d	4.69 (321)	5.22 (357)	5.22 (357)	5.22 (357)	5.00 (342)	5.22 (357)	5.22 (357)	5.22 (357)
				5.05 (345)	7.50 (513)	9.37 (641)	9.37 (641)	5.36 (367)	7.96 (545)	9.37 (641)	9.37 (641)
	12.5 mm (1/2")	35 mm (1-3/8")		5.60 (383)	8.31 (568)	10.58 (724)	13.72 (939)	5.90 (404)	8.77 (600)	11.16 (764)	14.48 (991)
	15.5 mm (5/8")	38 mm (1-1/2")		6.14 (420)	9.11 (624)	11.60 (794)	15.05 (1030)	6.45 (441)	9.57 (655)	12.19 (834)	15.81 (1082)
	12.5 mm (1/2")	35 mm (1-3/8")	10d	6.51 (445)	9.66 (661)	12.30 (842)	15.95 (1092)	6.88 (470)	10.21 (699)	13.00 (890)	16.86 (1155)
	15.5 mm (5/8")	38 mm (1-1/2")		7.08 (484)	10.51 (719)	13.38 (916)	17.36 (1189)	7.45 (510)	11.06 (757)	14.08 (964)	18.27 (1251)
W24	9.5 mm (3/8")	32 mm (1-1/4")	8d	5.05 (345)	7.50 (513)	9.06 (620)	9.06 (620)	5.36 (367)	7.96 (545)	9.06 (620)	9.06 (620)
2R24				5.05 (345)	7.50 (513)	9.55 (654)	10.31 (706)	5.36 (367)	7.96 (545)	10.14 (694)	10.31 (706)
W24	11 mm (7/16")	35 mm (1-3/8")		5.32 (364)	7.91 (541)	10.07 (689)	13.06 (894)	5.63 (385)	8.37 (572)	10.65 (729)	13.82 (946)
1R24/2F16				5.32 (364)	7.91 (541)	10.07 (689)	13.06 (894)	5.63 (385)	8.37 (572)	10.65 (729)	13.82 (946)
2R32/2F16	12 mm (15/32")			5.51 (376)	8.17 (559)	10.41 (712)	13.50 (924)	5.81 (398)	8.63 (591)	10.99 (752)	14.26 (976)
2R40/2F20	15 mm (19/32")	38 mm (1-1/2")		6.05 (413)	8.98 (614)	11.43 (782)	14.83 (1015)	6.36 (435)	9.44 (646)	12.02 (823)	15.59 (1067)
1F16				6.05 (413)	8.98 (614)	11.43 (782)	14.83 (1015)	6.36 (435)	9.44 (646)	12.02 (823)	15.59 (1067)
1F20				6.05 (413)	8.98 (614)	11.43 (782)	14.83 (1015)	6.36 (435)	9.44 (646)	12.02 (823)	15.59 (1067)
2R32/2F16	12 mm (15/32")	35 mm (1-3/8")	10d	6.41 (438)	9.52 (651)	12.12 (830)	15.72 (1076)	6.78 (464)	10.07 (689)	12.82 (878)	16.63 (1139)
2R40/2F20	15 mm (19/32")	38 mm (1-1/2")		6.98 (478)	10.37 (710)	13.20 (904)	17.12 (1172)	7.35 (503)	10.92 (747)	13.9 (952)	18.03 (1235)
1F16				6.98 (478)	10.37 (710)	13.20 (904)	17.12 (1172)	7.35 (503)	10.92 (747)	13.9 (952)	18.03 (1235)
1F20				6.98 (478)	10.37 (710)	13.20 (904)	17.12 (1172)	7.35 (503)	10.92 (747)	13.9 (952)	18.03 (1235)

Continued on next page

TABLE W5 (Continued)

FACTORED SHEAR RESISTANCE[a,b,c,d] FOR APA PANEL SHEAR WALLS[e,f,g,h,i]

a. Tabulated factored shear resistances are in accordance with the NBC and CSA O86.

b. Tabulated values are based on short-term loading (K_D = 1.15). Lumber must be seasoned prior to fabrication (moisture content ≤ 19%) and shall be used in dry service conditions (K_{SF} = 1.0).

c. Underlined values are governed by the panel buckling strength for a panel size of 2440 mm x 1220 mm (8 ft. x 4 ft.) and are not appropriate for seismic design.

d. The shaded shear resistances where the fastener spacing at panel edges is 50 mm (2 inches) or 75 mm (3 inches), the framing at adjoining panel edges shall be 64 mm (3 inches nominal) or thicker (or two 38 mm or 2 inches nominal thickness members connected to transfer the factor shear force), and the fasteners shall be staggered.

e. All panel edges shall be backed with 38 mm (2 inches nominal) or wider framing. Install panels either horizontally or vertically. Space nails maximum 300 mm (12 inches) on center along the intermediate framing members.

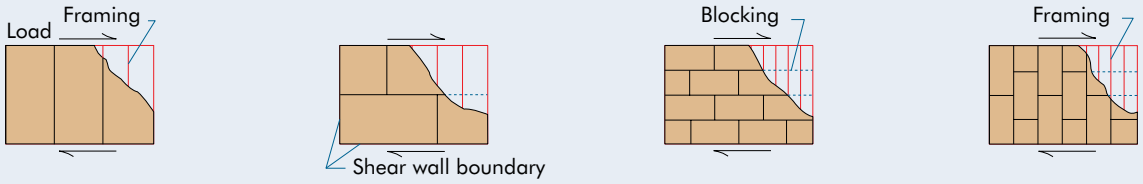
f. Where panels are applied on both faces of the wall and nail spacing is less than 150 mm (6 inches) on center on either side, panel joints shall be offset to fall on different framing members, or framing shall be 64 mm (3 inches nominal) or thicker at adjoining panel edges, and nails on each side shall be staggered.

g. For panels that are applied directly to the framing members as exterior siding, the minimum panel thickness shall be 9.5 mm (3/8 inch).

h. Shear walls using plywood or OSB shall be constructed with panels not less than 7.5 mm (19/64 inch).

i. For panels applied over 12.7 mm (1/2 inch) or 15.9 mm (5/8 inch) gypsum wallboard, specified shear strength for the same thickness panel applied directly to the framing could be used if the minimum nail penetration into the framing is satisfied.

Typical Layout for Shear Walls



Designing for Combined Shear and Wind Uplift

Wind uplift resistance can be achieved from wood structural panels designed as a shear wall, with a specific attachment schedule associated with the desired shear capacity, by increasing the nails at the top and bottom of the wall sheathing panel. These additional nails are used to transfer the uplift force from the top plate to the panel, from panel to panel at a splice location (if present) and from panel to sole plate at the foundation, effectively eliminating the need for uplift straps at these locations. Uplift straps will still be required around window and door openings in the exterior walls to transfer the uplift loads acting on the header to the foundation below. Since the total number of straps is reduced, however, the builder saves time and money and does not have to work around as many straps when fastening other elements of the structure, such as shear wall hold-downs and siding.

One of the factors making this design system simple and easy to use is the high shear capacity of wood structural panels. Because of the limitations of nailed connections in lumber, only a small fraction of the panel shear capacity is actually used in a shear wall. While it is true that putting a panel in tension reduces its shear capacity, there is sufficient residual shear capacity left to permit the panels to be used in combined shear and uplift. See APA System Report SR-101, *Design for Combined Shear and Uplift from Wind*, for more information.

Design for Transverse Wind Load

Tables W6 and W7 provide the maximum specified wind load for APA wood structural panels made of DFP/CSP plywood and OSB, respectively. The maximum specified wind load can be used in the wind design in accordance with NBC Section 4.1.7.3, which is a function of the importance factor for wind load (I_w), referenced velocity (q), exposure factor (C_e), topographic factor (C_t), gust effect factor (C_g), and external pressure coefficient (C_p).

TABLE W6

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED DFP/CSP PLYWOOD PANELS[a] APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Panel Nominal Thickness (mm)	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/ Intermediate Supports	Maximum Specified Wind Load[f,g]	
	Type	Shank Diameter			Panel Strength Axis Perp. to Supports	Panel Strength Axis Parallel to Supports
9.5 mm (3/8")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.25 kPa (26 psf)	0.63 kPa (13 psf)
				150/150 mm (6"/6")	2.51 kPa (52 psf)	0.63 kPa (13 psf)
				100/100 mm (4"/4")	3.60 kPa (76 psf)	0.63 kPa (13 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	0.63 kPa (13 psf)
			600 mm (24")	150/300 mm (6"/12")	0.83 kPa (17 psf)	0.22 kPa (4 psf)
				150/150 mm (6"/6")	1.67 kPa (35 psf)	0.22 kPa (4 psf)
				100/100 mm (4"/4")	2.51 kPa (52 psf)	0.22 kPa (4 psf)
				75/75 mm (3"/3")	3.35 kPa (70 psf)	0.22 kPa (4 psf)
	10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.71 kPa (35 psf)	0.63 kPa (13 psf)
				150/150 mm (6"/6")	3.43 kPa (71 psf)	0.63 kPa (13 psf)
				100/100 mm (4"/4")	3.60 kPa (76 psf)	0.63 kPa (13 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	0.63 kPa (13 psf)
			600 mm (24")	150/300 mm (6"/12")	1.14 kPa (23 psf)	0.22 kPa (4 psf)
				150/150 mm (6"/6")	2.28 kPa (47 psf)	0.22 kPa (4 psf)
				100/100 mm (4"/4")	3.43 kPa (71 psf)	0.22 kPa (4 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	0.22 kPa (4 psf)
12.5 mm (1/2")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.18 kPa (24 psf)	1.18 kPa (24 psf)
				150/150 mm (6"/6")	2.37 kPa (49 psf)	2.37 kPa (49 psf)
				100/100 mm (4"/4")	3.56 kPa (74 psf)	3.56 kPa (74 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	0.79 kPa (16 psf)	0.79 kPa (16 psf)
				150/150 mm (6"/6")	1.58 kPa (33 psf)	1.57 kPa (32 psf)
				100/100 mm (4"/4")	2.37 kPa (49 psf)	1.57 kPa (32 psf)
				75/75 mm (3"/3")	3.16 kPa (66 psf)	1.57 kPa (32 psf)
	10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.63 kPa (34 psf)	1.63 kPa (34 psf)
				150/150 mm (6"/6")	3.27 kPa (68 psf)	3.27 kPa (68 psf)
				100/100 mm (4"/4")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	1.09 kPa (22 psf)	1.09 kPa (22 psf)
				150/150 mm (6"/6")	2.18 kPa (45 psf)	1.57 kPa (32 psf)
				100/100 mm (4"/4")	3.27 kPa (68 psf)	1.57 kPa (32 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	1.57 kPa (32 psf)

Continued on next page

TABLE W6 (Continued)

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED DFP/CSP PLYWOOD PANELS[a] APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Panel Nominal Thickness (mm)	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/ Intermediate Supports	Maximum Specified Wind Load[f,g]	
	Type	Shank Diameter			Panel Strength Axis Perp. to Supports	Panel Strength Axis Parallel to Supports
15.5 mm (5/8")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.11 kPa (23 psf)	1.11 kPa (23 psf)
				150/150 mm (6"/6")	2.23 kPa (46 psf)	2.23 kPa (46 psf)
				100/100 mm (4"/4")	3.35 kPa (70 psf)	3.35 kPa (70 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	0.74 kPa (15 psf)	0.74 kPa (15 psf)
				150/150 mm (6"/6")	1.49 kPa (31 psf)	1.49 kPa (31 psf)
				100/100 mm (4"/4")	2.23 kPa (46 psf)	2.23 kPa (46 psf)
				75/75 mm (3"/3")	2.98 kPa (62 psf)	2.98 kPa (62 psf)
	10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.56 kPa (32 psf)	1.56 kPa (32 psf)
				150/150 mm (6"/6")	3.12 kPa(65 psf)	3.12 kPa (65 psf)
				100/100 mm (4"/4")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	1.04 kPa (21 psf)	1.04 kPa (21 psf)
				150/150 mm (6"/6")	2.08 kPa (43 psf)	2.08 kPa (43 psf)
				100/100 mm (4"/4")	3.12 kPa (65 psf)	3.12 kPa (65 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)

Notes:

a. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 12.7 mm (1/2 inch). Fasteners shall be located 9.5 mm (3/8 inch) from panel edges. Panels shall be installed over two or more spans, fully loaded.

b. Hot-dip galvanized nails are recommended for most siding applications.

c. Nail dimensions shall be in accordance with Table W2.

d. Nail penetration into the stud is equal to the nail length minus panel thickness.

e. Maximum stud spacing for braced wall panels shall be in accordance with Table W4.

f. Maximum specified wind load is based on nail withdrawal, nail head pull-through, and panel capacities and stiffness (deflection limit of L/120), and is limited to 3.60 kPa (76 psf).

g. Based on **dry service conditions** and short-term duration of load (K_D = 1.15).

TABLE W7

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED OSB PANELS[a] APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Span Rating	Panel Nominal Thickness (mm)	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/ Intermediate Supports	Maximum Specified Wind Load [f,g]	
		Type	Shank Diameter			Panel Strength Axis Perp. to Supports	Panel Strength Axis Parallel to Supports
W24	9.5 mm (3/8") or 11 mm (7/16")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.22 kPa (25 psf)	1.22 kPa (25 psf)
					150/150 mm (6"/6")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
					100/100 mm (4"/4")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
					75/75 mm (3"/3")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
				600 mm (24")	150/300 mm (6"/12")	0.81 kPa (17 psf)	0.81 kPa (17 psf)
					150/150 mm (6"/6")	1.63 kPa (34 psf)	0.82 kPa (17 psf)
					100/100 mm (4"/4")	1.80 kPa (38 psf)	0.82 kPa (17 psf)
					75/75 mm (3"/3")	1.80 kPa (38 psf)	0.82 kPa (17 psf)
		10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.67 kPa (35 psf)	1.67 kPa (35 psf)
					150/150 mm (6"/6")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
					100/100 mm (4"/4")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
					75/75 mm (3"/3")	1.80 kPa (38 psf)	1.80 kPa (38 psf)
				600 mm (24")	150/300 mm (6"/12")	1.11 kPa (23 psf)	0.82 kPa (17 psf)
					150/150 mm (6"/6")	1.80 kPa (38 psf)	0.82 kPa (17 psf)
					100/100 mm (4"/4")	1.80 kPa (38 psf)	0.82 kPa (17 psf)
					75/75 mm (3"/3")	1.80 kPa (38 psf)	0.82 kPa (17 psf)
2R24	9.5 mm (3/8")	8d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.71 kPa (35 psf)	1.71 kPa (35 psf)
					150/150 mm (6"/6")	3.43 kPa (71 psf)	2.22 kPa (46 psf)
					100/100 mm (4"/4")	3.60 kPa (76 psf)	2.22 kPa (46 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	2.22 kPa (46 psf)
				600 mm (24")	150/300 mm (6"/12")	1.14 kPa (23 psf)	0.82 kPa (17 psf)
					150/150 mm (6"/6")	2.28 kPa (47 psf)	0.82 kPa (17 psf)
					100/100 mm (4"/4")	3.12 kPa (65 psf)	0.82 kPa (17 psf)
					75/75 mm (3"/3")	3.12 kPa (65 psf)	0.82 kPa (17 psf)
		10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.71 kPa (35 psf)	1.71 kPa (35 psf)
					150/150 mm (6"/6")	3.43 kPa (71 psf)	2.22 kPa (46 psf)
					100/100 mm (4"/4")	3.60 kPa (76 psf)	2.22 kPa (46 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	2.22 kPa (46 psf)
				600 mm (24")	150/300 mm (6"/12")	1.14 kPa (23 psf)	0.82 kPa (17 psf)
					150/150 mm (6"/6")	2.28 kPa (47 psf)	0.82 kPa (17 psf)
					100/100 mm (4"/4")	3.12 kPa (65 psf)	0.82 kPa (17 psf)
					75/75 mm (3"/3")	3.12 kPa (65 psf)	0.82 kPa (17 psf)

Continued on next page

TABLE W7 (Continued)

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED OSB PANELS[a] APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Span Rating	Panel Nominal Thickness (mm)	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/ Intermediate Supports	Maximum Specified Wind Load[f,g]	
		Type	Shank Diameter			Panel Strength Axis Perp. to Supports	Panel Strength Axis Parallel to Supports
1R24/2F16	11 mm (7/16")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.22 kPa (25 psf)	1.22 kPa (25 psf)
					150/150 mm (6"/6")	2.44 kPa (51 psf)	2.44 kPa (51 psf)
					100/100 mm (4"/4")	3.60 kPa (76 psf)	2.65 kPa (55 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	2.65 kPa (55 psf)
				600 mm (24")	150/300 mm (6"/12")	0.81 kPa (17 psf)	0.81 kPa (17 psf)
					150/150 mm (6"/6")	1.63 kPa (34 psf)	1.16 kPa (24 psf)
					100/100 mm (4"/4")	2.44 kPa (51 psf)	1.16 kPa (24 psf)
					75/75 mm (3"/3")	3.26 kPa (68 psf)	1.16 kPa (24 psf)
		10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.67 kPa (35 psf)	1.67 kPa (35 psf)
					150/150 mm (6"/6")	3.35 kPa (70 psf)	2.65 kPa (55 psf)
					100/100 mm (4"/4")	3.60 kPa (76 psf)	2.65 kPa (55 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	2.65 kPa (55 psf)
				600 mm (24")	150/300 mm (6"/12")	1.11 kPa (23 psf)	1.11 kPa (23 psf)
					150/150 mm (6"/6")	2.23 kPa (46 psf)	1.16 kPa (24 psf)
					100/100 mm (4"/4")	3.35 kPa (70 psf)	1.16 kPa (24 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	1.16 kPa (24 psf)
2R32/2F16	12 mm (15/32")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.19 kPa (25 psf)	1.19 kPa (25 psf)
					150/150 mm (6"/6")	2.39 kPa (50 psf)	2.39 kPa (50 psf)
					100/100 mm (4"/4")	3.59 kPa (75 psf)	3.59 kPa (75 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
				600 mm (24")	150/300 mm (6"/12")	0.79 kPa (16 psf)	0.79 kPa (16 psf)
					150/150 mm (6"/6")	1.59 kPa (33 psf)	1.59 kPa (33 psf)
					100/100 mm (4"/4")	2.39 kPa (50 psf)	1.73 kPa (36 psf)
					75/75 mm (3"/3")	3.19 kPa (66 psf)	1.73 kPa (36 psf)
		10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.65 kPa (34 psf)	1.65 kPa (34 psf)
					150/150 mm (6"/6")	3.30 kPa (69 psf)	3.30 kPa (69 psf)
					100/100 mm (4"/4")	4.60 kPa (96 psf)	3.90 kPa (81 psf)
					75/75 mm (3"/3")	4.60 kPa (96 psf)	3.90 kPa (81 psf)
				600 mm (24")	150/300 mm (6"/12")	1.10 kPa (23 psf)	1.10 kPa (23 psf)
					150/150 mm (6"/6")	2.20 kPa (46 psf)	1.73 kPa (36 psf)
					100/100 mm (4"/4")	3.30 kPa (69 psf)	1.73 kPa (36 psf)
					75/75 mm (3"/3")	4.40 kPa (92 psf)	1.73 kPa (36 psf)

Continued on next page

TABLE W7 (Continued)

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED OSB PANELS[a] APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Span Rating	Panel Nominal Thickness (mm)	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/ Intermediate Supports	Maximum Specified Wind Load[f,g]	
		Type	Shank Diameter			Panel Strength Axis Perp. to Supports	Panel Strength Axis Parallel to Supports
2R40/2F20	15 mm (19/32")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.12 kPa (23 psf)	1.12 kPa (23 psf)
					150/150 mm (6"/6")	2.25 kPa (47 psf)	2.25 kPa (47 psf)
					100/100 mm (4"/4")	3.38 kPa (70 psf)	3.38 kPa (70 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
				600 mm (24")	150/300 mm (6"/12")	0.75 kPa (15 psf)	0.75 kPa (15 psf)
					150/150 mm (6"/6")	1.50 kPa (31 psf)	1.50 kPa (31 psf)
					100/100 mm (4"/4")	2.25 kPa (47 psf)	2.25 kPa (47 psf)
					75/75 mm (3"/3")	3.01 kPa (62 psf)	2.77 kPa (57 psf)
		10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.57 kPa (32 psf)	1.57 kPa (32 psf)
					150/150 mm (6"/6")	3.14 kPa (65 psf)	3.14 kPa (65 psf)
					100/100 mm (4"/4")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	3.60 kPa (76 psf)
				600 mm (24")	150/300 mm (6"/12")	1.04 kPa (21 psf)	1.04 kPa (21 psf)
					150/150 mm (6"/6")	2.09 kPa (43 psf)	2.09 kPa (43 psf)
					100/100 mm (4"/4")	3.14 kPa (65 psf)	2.77 kPa (57 psf)
					75/75 mm (3"/3")	3.60 kPa (76 psf)	2.77 kPa (57 psf)

Notes:

a. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 12.7 mm (1/2 inch). Fasteners shall be located 9.5 mm (3/8 inch) from panel edges. Panels shall be installed over two or more spans, fully loaded.

b. Hot-dip galvanized nails are recommended for most siding applications.

c. Nail dimensions shall be in accordance with Table W2.

d. Nail penetration into the stud is equal to the nail length minus panel thickness.

e. Maximum stud spacing for braced wall panels shall be in accordance with Table W4.

f. Maximum specified wind load is based on nail withdrawal, nail head pull-through, and panel capacities and stiffness (deflection limit of L/120), and is limited to 3.60 kPa (76 psf) for all span ratings except for W24 in which the limit is 1.80 kPa (38 psf).

g. Based on **dry service conditions** and short-term duration of load (K_D = 1.15).

Energy-Efficient Framing

"Energy-efficient 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. Energy-efficient framing techniques include using 2x6 wood studs placed 600 mm (24 inches) on center with wood structural panel wall sheathing, designing corners and intersecting walls with insulated spaces and using headers that provide space for insulation. See Figure W5. These framing techniques can increase the energy efficiency of homes. The most common energy-efficient framing techniques require little in the way of new skills or additional cost.

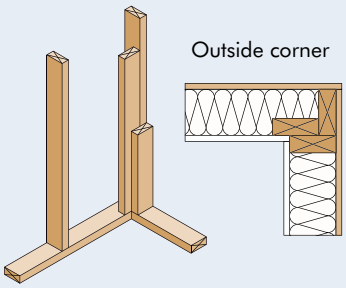
Energy-efficient framing boosts whole wall R-value (resistance to heat flow) by maximizing space for cavity insulation. When 2x6 framing is used with double top plates, there is no need to vertically align framing members. Consult APA's *Advanced Framing Construction Guide*, Form M400, for further information on advanced framing techniques.

Studs at sides of openings shall comply with NBC Section 9.23.10.6. According to NBC Section 9.23.11.3, top plates shall be doubled, except in a loadbearing wall with a header where the top plate forms a tie across the header, where the studs from above are aligned with the studs below or where the maximum offset between the upper and lower studs does not exceed 50 mm (2 inches).

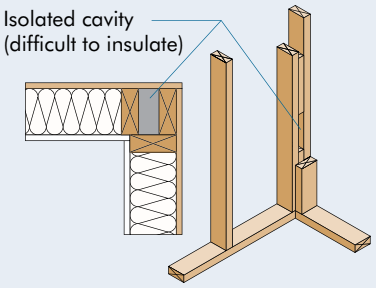
FIGURE W5

THREE-STUD CORNERS

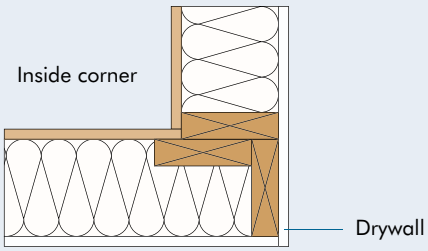
INSULATED THREE-STUD CORNER (CALIFORNIA CORNER)



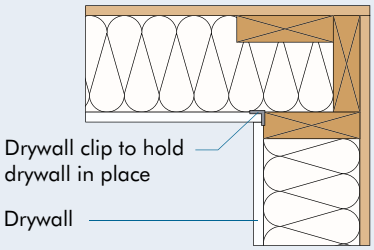
CONVENTIONAL CORNER



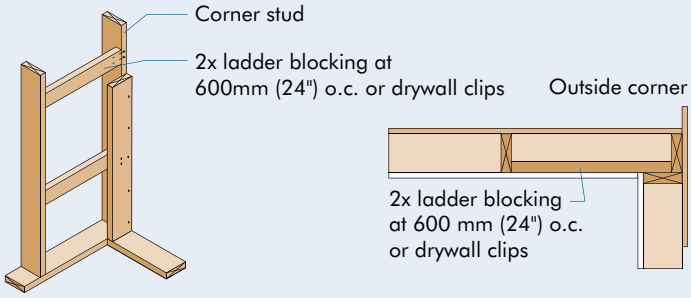
INSULATED THREE-STUD CORNER (INSIDE CORNER)



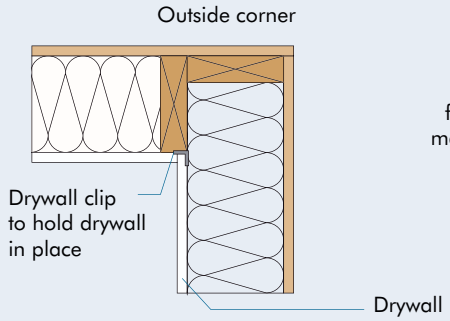
ALTERNATE INSULATED THREE-STUD CORNER (WITH DRYWALL CLIPS)



TWO-STUD CORNERS



TWO-STUD CORNER (WITH DRYWALL CLIPS)



TWO-STUD INSIDE CORNER (FOR WALL PANELIZATION)

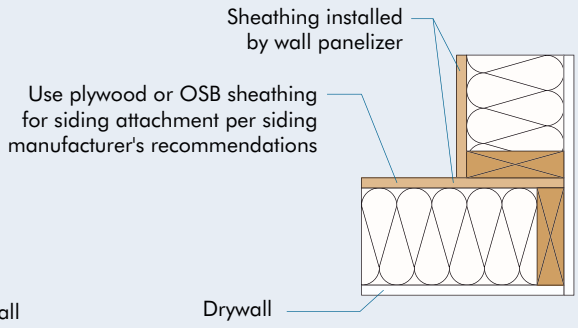
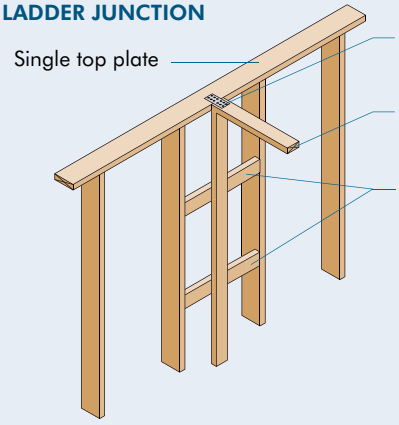


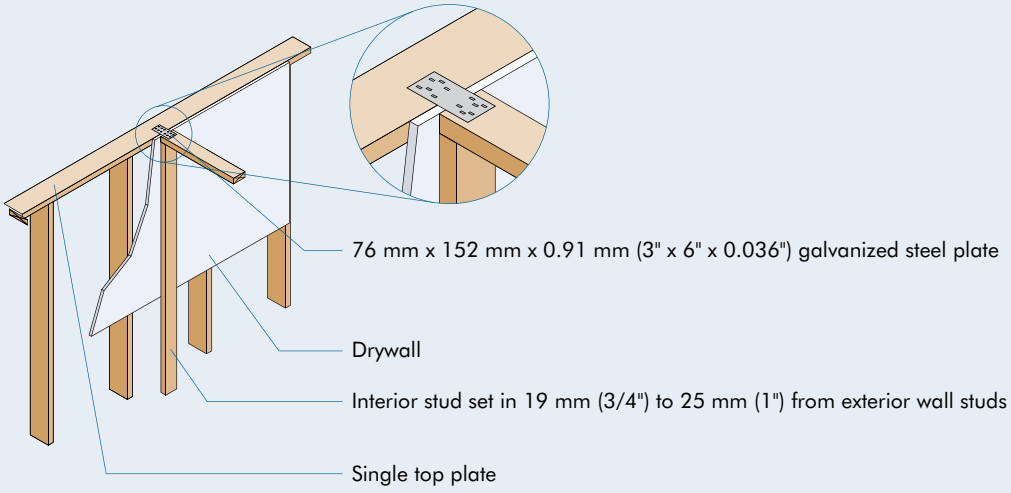
FIGURE W5 (Continued)

INTERIOR WALL INTERSECTION OPTIONS

LADDER JUNCTION



JUNCTION FOR CONTINUOUS DRYWALL APPLICATION



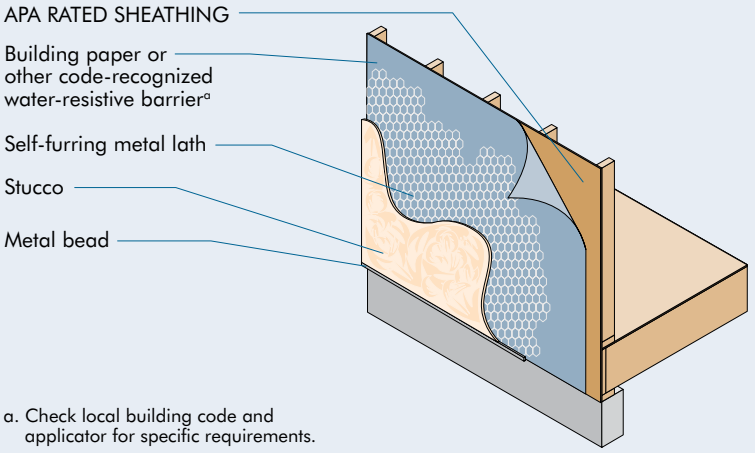
Detail courtesy of Home Innovation Research Labs.

APA Rated Sheathing Under Stucco

Greater stiffness is recommended for wall sheathing when stucco is to be applied. To increase stiffness, the long panel dimension or strength axis across studs should be applied (see Figure W6). Blocking or a plywood cleat is recommended at horizontal joints. Blocking is required for shear wall and wall bracing applications. According to NBC Section 9.28.3.2, nails for attaching stucco lath or reinforcing to vertical surfaces shall be of sufficient length to penetrate 25 mm (1 inch) into framing members or to the full depth of the sheathing where the sheathing is used for attachment. Nails shall be not less than 3.2 mm (0.126 inch) in diameter with a head diameter of not less than 11 mm (7/16 inch). On horizontal surfaces, nails for stucco lath or reinforcing shall be not less than 38 mm (1-1/2-inch) long.

FIGURE W6

STUCCO OVER APA PANEL SHEATHING



a. Check local building code and applicator for specific requirements.

According to NBC Section 9.27.5.1, stucco lath is permitted to be attached directly to sheathing only where the sheathing thickness is not less than 12.5 mm (1/2 inch) for plywood and OSB.

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 W8 shows the use of wood structural panel sheathing as a nail base with lightweight claddings. Popular lightweight cladding products include vinyl, wood, aluminum, fiber cement, APA-Rated panel siding, wood shingles/ shakes and synthetic stucco products. For claddings with weights of 144 Pa (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 144 Pa (3 psf) require additional consideration when fastening directly to sheathing.

TABLE W8

OPTIONAL SIDING[a] ATTACHMENT SCHEDULE FOR FASTENERS WHERE NO STUD PENETRATION IS NECESSARY

Application	Type of Fastener	Spacing of Fasteners[b]
Exterior wall covering, weighing 144 Pa (3 psf) or less attachment to wood structural panel sheathing, either direct or over foam sheathing a maximun of 51 mm (2") thick.[c]	Ring-shank roofing nail 3 mm (0.120") min. dia.	300 mm (12") o.c.
	No. 6 wood screw 3.5 mm (0.138") min. dia.	300 mm (12") o.c.
	No. 8 wood screw 4.16 mm (0.16") min. dia.	400 (16") o.c.

a. Does not apply to vertical siding.

b. Spacing of fasteners is per 300 mm (12 inches) of siding width. For other siding widths, multiply "Spacing of Fasteners" above by a factor of 30/s, where "s" is the siding width in mm. Fastener spacing shall never be greater than the manufacturer's minimum recommendations.

c. Fastener length shall be sufficient to penetrate the back side of the wood structural panel sheathing by at least 7 mm (9/32 inch). The wood structural panel sheathing shall be not less than 11 mm (7/16 inch) in thickness.

APA Rated Sheathing Installation Procedures

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 RATED SHEATHING could be used as wall cladding applied directly to studs or over nonstructural fiberboard, gypsum or to rigid foam insulation sheathing (see Figure W7). Nonstructural sheathing is defined as sheathing not recognized by building codes for meeting both bending and racking strength requirements.

APA Rated Plywood Cladding (Siding)

APA Rated plywood cladding shall be of exterior type conforming to CSA O121 for Douglas Fir Plywood or CSA O151 for Canadian Softwood Plywood with the minimum thickness in accordance with Table W9.

TABLE W9

MINIMUM PLYWOOD CLADDING THICKNESS[a]

	Plywood Cladding Minimum Thickness When Applied Directly to Wall Framing[b]	
Spacing of Supports	Face Grain Parallel to Supports	Face Grain Perpendicular to Support
400 mm (16")	8 mm (5/16")	6 mm (1/4")
600 mm (24")	11 mm (7/16")	8 mm (5/16")

a. Based on NBC Section 9.27.8.2

b. When applied to nail-base sheathing (minimum 9.5 mm or 3/8 inch in thickness), the plywood cladding thickness shall be 6 mm (1/4 inch) or thicker.

Minimum nail length for cladding attachment in accordance with NBC Table 9.27.5.4:

1. Panel type cladding thickness less than 7 mm (9/32 inch): Min. nail length = 38 mm (1-1/2 inches)

2. Panel type cladding thickness more than 7 mm (9/32 inch): Min. nail length = 51 mm (2 inches)

APA RATED SIDING is a single layer of wood structural panel cladding. Due to its strong racking resistance, the cost of installing separate structural sheathing or diagonal wall bracing can be eliminated.

APA RATED SIDING could be installed over rigid foam insulation sheathing by driving 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. When rigid foam insulation sheathing is used, building codes also generally require installation of 12.7 mm (1/2-inch) gypsum wallboard or other materials of the required thermal barrier rating on the inside surface of the wall for fire protection.

APA RATED SIDING could be installed over nailable sheathing (see Figures W7 and W8). See APA's *Build A Better Home: Walls*, Form A530, for additional recommendations to avoid moisture penetration in walls.

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.

APA RATED SIDING can be installed vertically (long dimension along supports) or horizontally (long dimension across supports) if horizontal joints are blocked. Table W10 provides the specified wind load for APA RATED PANEL SIDING applied directly to studs or over nonstructural sheathing, defined as sheathing not recognized by building codes for meeting both bending and racking strength requirements. Table W11 provides the specified wind load for APA RATED SIDING when installed over nailable sheathing. All panel siding edges should be backed with framing or blocking. Use nonstaining, noncorrosive nails to prevent staining the siding. Where siding is to be applied at an angle, install only over wood structural panel sheathing.

FIGURE W7

SIDING APPLIED DIRECTLY TO THE FRAMING SUPPORTS (Vertical Panel Installation)

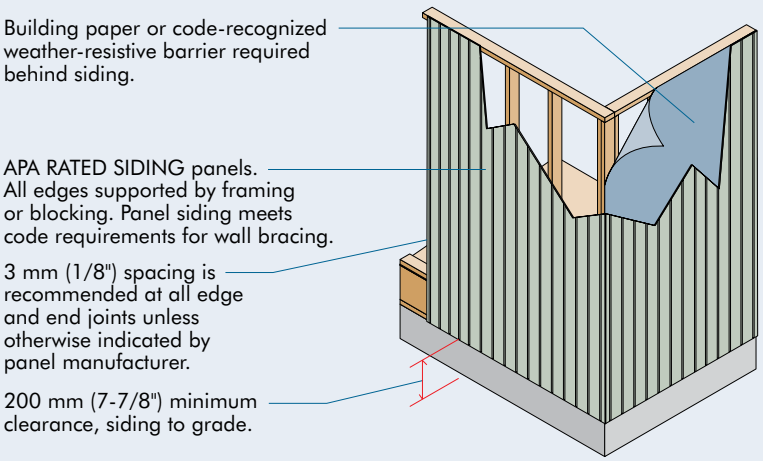
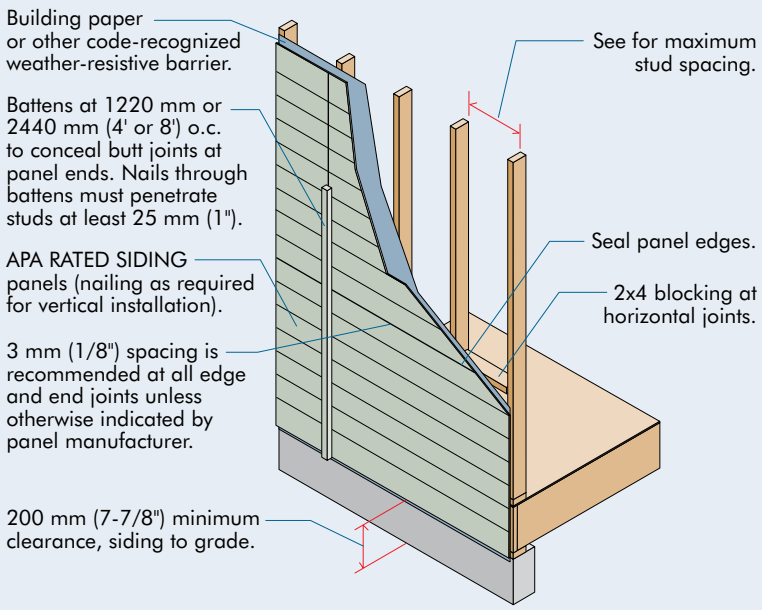


FIGURE W8

APA RATED SIDING (Horizontal Panel Siding Installation)



Note: Panel siding shall meet code requirements for wall bracing.

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

TABLE W10

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED DFP/CSP PANEL SIDING[a] (WET SERVICE CONDITIONS) APPLIED DIRECT-TO-STUDS (SPF OR HIGHER RELATIVE DENSITY)

Panel Nominal Thickness	Minimum Nail[b,c,d] Type	Minimum Nail[b,c,d] Shank Diameter	Wall Stud o.c. Spacing[e]	Panel Nail o.c. at Edge/ Intermediate Supports	Maximum Specified Wind Load[f,g,h]
9.5 mm (3/8")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	0.54 kPa (11 psf)
				150/150 mm (6"/6")	0.54 kPa (11 psf)
				100/100 mm (4"/4")	0.54 kPa (11 psf)
				75/75 mm (3"/3")	0.54 kPa (11 psf)
			600 mm (24")	150/300 mm (6"/12")	0.19 kPa (3 psf)
				150/150 mm (6"/6")	0.19 kPa (3 psf)
				100/100 mm (4"/4")	0.19 kPa (3 psf)
				75/75 mm (3"/3")	0.19 kPa (3 psf)
	10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	0.54 kPa (11 psf)
				150/150 mm (6"/6")	0.54 kPa (11 psf)
				100/100 mm (4"/4")	0.54 kPa (11 psf)
				75/75 mm (3"/3")	0.54 kPa (11 psf)
			600 mm (24")	150/300 mm (6"/12")	0.19 kPa (3 psf)
				150/150 mm (6"/6")	0.19 kPa (3 psf)
				100/100 mm (4"/4")	0.19 kPa (3 psf)
				75/75 mm (3"/3")	0.19 kPa (3 psf)
12.5 mm (1/2")	8d	3.33 mm (0.131")	400 mm (16")	150/300 mm (6"/12")	1.18 kPa (24 psf)
				150/150 mm (6"/6")	2.37 kPa (49 psf)
				100/100 mm (4"/4")	3.56 kPa (74 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	0.79 kPa (16 psf)
				150/150 mm (6"/6")	1.33 kPa (27 psf)
				100/100 mm (4"/4")	1.33 kPa (27 psf)
				75/75 mm (3"/3")	1.33 kPa (27 psf)
	10d	3.76 mm (0.148")	400 mm (16")	150/300 mm (6"/12")	1.63 kPa (34 psf)
				150/150 mm (6"/6")	3.27 kPa (68 psf)
				100/100 mm (4"/4")	3.60 kPa (76 psf)
				75/75 mm (3"/3")	3.60 kPa (76 psf)
			600 mm (24")	150/300 mm (6"/12")	1.09 kPa (22 psf)
				150/150 mm (6"/6")	1.33 kPa (27 psf)
				100/100 mm (4"/4")	1.33 kPa (27 psf)
				75/75 mm (3"/3")	1.33 kPa (27 psf)

Notes:

a. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 12.7 mm (1/2 inch). Fasteners shall be located 9.5 mm (3/8 inch) from panel edges. Siding shall be installed over two or more spans, fully loaded.

b. Hot-dip galvanized nails are recommended for most siding applications.

c. Nail dimensions shall be in accordance with Table W2.

d. Nail penetration into the stud is equal to the nail length minus panel thickness.

e. Maximum stud spacing for braced wall panels shall be in accordance with Table W4.

f. Maximum specified wind load is based on nail withdrawal, nail head pull-through, and panel capacities and stiffness (deflection limit of L/120), and is limited to 3.60 kPa (76 psf).

g. APA panel siding strength axis is parallel or perpendicular to supports.

h. Based on **wet service conditions** for the panel siding and short-term duration of load (K_D = 1.15).

TABLE W11

MAXIMUM SPECIFIED WIND LOAD (K_D = 1.15) FOR APA RATED DFP/CSP PANEL SIDING[a] (WET SERVICE CONDITIONS) APPLIED TO NAIL-BASE SHEATHING[i]

Panel Nominal Thickness	Minimum Nail[b,c,d]		Wall Stud o.c. Spacing[e]	Panel Nail o.c. Spacing at Edge/Intermediate Supports	Maximum Specified Wind Load[f,g,h]
	Shank Diameter	Penetration in the Nail Based Sheathing			
9.5 mm (3/8")	3.05 mm (0.120")	12.5 mm (1/2")	400 mm (16")	150/300 mm (6"/12")	0.24 kPa (5 psf)
				150/150 mm (6"/6")	0.48 kPa (10 psf)
				100/100 mm (4"/4")	0.54 kPa (11 psf)
				75/75 mm (3"/3")	0.54 kPa (11 psf)
12.5 mm (1/2")			400 mm (16")	150/300 mm (6"/12")	0.24 kPa (5 psf)
				150/150 mm (6"/6")	0.48 kPa (10 psf)
				100/100 mm (4"/4")	0.73 kPa (15 psf)
				75/75 mm (3"/3")	0.97 kPa (20 psf)
			600 mm (24")	150/300 mm (6"/12")	0.16 kPa (3 psf)
				150/150 mm (6"/6")	0.32 kPa (6 psf)
				100/100 mm (4"/4")	0.48 kPa (10 psf)
				75/75 mm (3"/3")	0.64 kPa (13 psf)

Notes:

a. Supported panel joints shall occur approximately along the centerline of framing with a minimum bearing of 12.7 mm (1/2 inch). Fasteners shall be located 9.5 mm (3/8 inch) from panel edges. Siding shall be installed over two or more spans, fully loaded.

b. Hot-dip galvanized nails are recommended for most siding applications.

c. Nail dimensions shall be in accordance with Table W2.

d. Ring-shank nail shall be used.

e. Maximum stud spacing for braced wall panels shall be in accordance with Table W4.

f. Maximum specified wind load is based on nail withdrawal, nail head pull-through, and panel capacities and stiffness (deflection limit of L/120), and is limited to 3.60 kPa (76 psf).

g. APA panel siding strength axis is parallel or perpendicular to supports.

h. Based on **wet service conditions** for the panel siding and short-term duration of load.

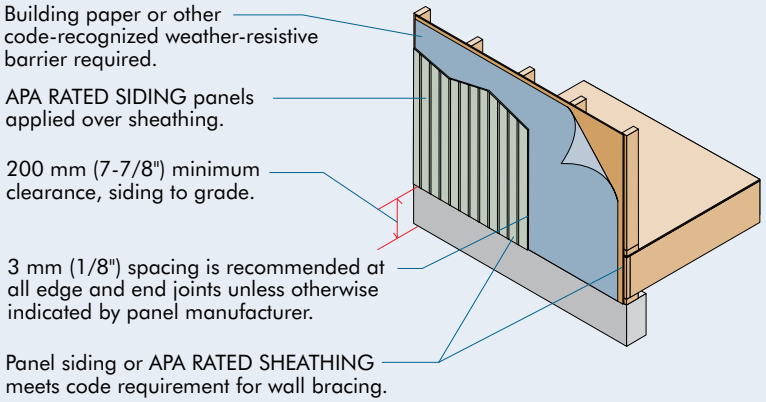
i. The thickness of nail-base sheathing shall be 9.5 mm (3/8 inch) or thicker.

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 when nails are further protected by yellow chromate coating. 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 W9

APA RATED PANEL SIDING OVER WOOD STRUCTURAL PANEL SHEATHING



Siding Joint Details

The siding joint details in Figure W10 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 of 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 3-mm (1/8-inch) space is recommended at all edge and end joints unless otherwise indicated by the panel manufacturer. If caulk is to be used, also check with the caulk manufacturer for recommended edge spacing. Nails through battens or other wood trim must penetrate at least 25 mm (1 inch) into studs. Nail panel siding 150 mm (6 inches) o.c. along edges and 300 mm (12 inches) o.c. at intermediate supports. To prevent staining of siding, use hot-dip galvanized, aluminum or other nonstaining nails.

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 does not 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.

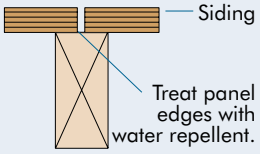
Apply flashing or other means of protection over end grain of siding to minimize water absorption.

FIGURE W10

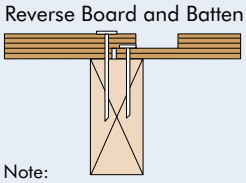
TYPICAL PANEL SIDING JOINT DETAILS
Note: Water-resistive barrier (building paper or house wrap omitted from figure for clarity) is required behind siding.

VERTICAL WALL JOINTS

Butt

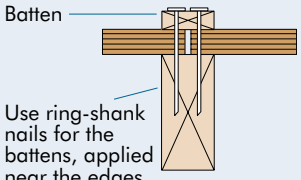


Shiplap



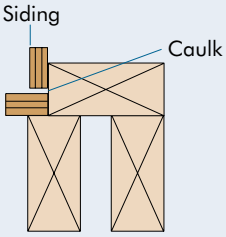
Note:
Nailing of both panel edges along shiplap joint is recommended. The "double nailing" is required when wall segment must meet wall bracing or engineered shear wall requirements.

Vertical Batten

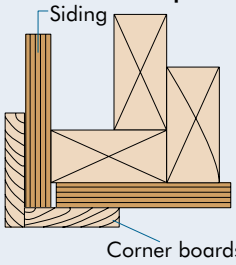


VERTICAL INSIDE & OUTSIDE CORNER JOINTS

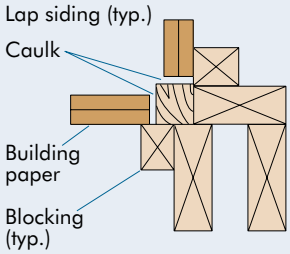
Butt & Caulk

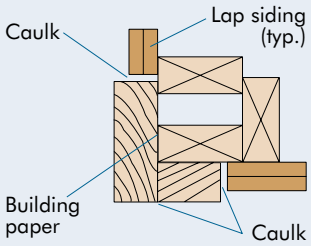


Corner Board Lap Joints



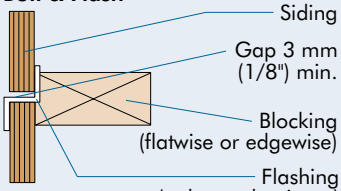
Lap Siding (APA Sturd-I-Wall)



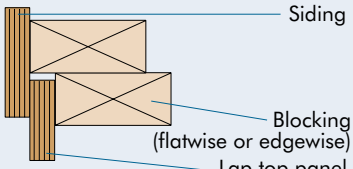


HORIZONTAL WALL JOINTS

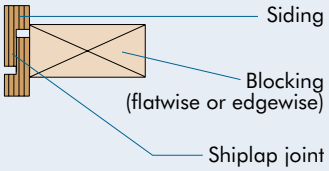
Butt & Flash



Lap



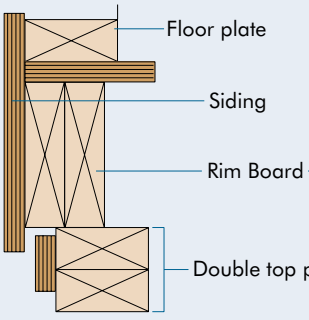
Shiplap



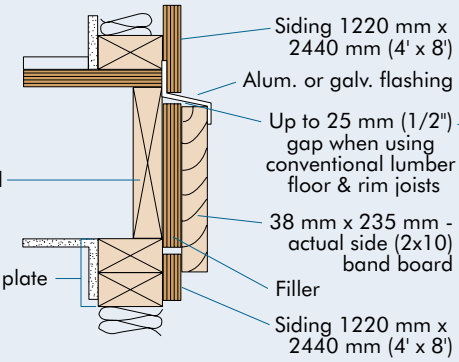
HORIZONTAL BELTLINE JOINTS

(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.)

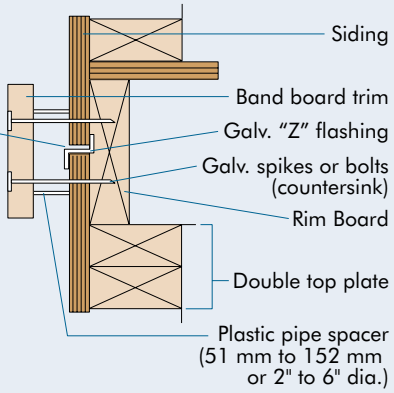
Jog Exterior Stud Line



Band Board Over Panel Filler



Band Board In Relief



WINDOW DETAILS

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

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 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 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. 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.

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.

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 10° C (50° F) within 24 hours for latex finishes, or 4° C (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.

Engineered Wood Wall Systems

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

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