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LP® SolidStart® Laminated Strand Lumber (LSL) and Laminated Veneer Lumber (LVL)

PR-L280(C)

Louisiana-Pacific Corporation

Revised July 21, 2017

Products: LP SolidStart 1.35E, 1.55E, and 1.75E LSL
LP SolidStart 1750F_b-1.3E LVL Rim Board
LP SolidStart 2250F_b-1.5E, 2400F_b-1.7E, 2650F_b-1.9E, 2900F_b-2.0E, 2950F_b-2.0E, 3100F_b-2.1E, and 3100F_b-2.2E LVL

LP Building Products, Louisiana-Pacific Corporation, 414 Union Street, Suite 2000, Nashville, Tennessee 37219
(615) 986-5600
customer.support@lpcorp.com
www.lpcorp.com

1. Basis of the product report:
   - 2015 National Building Code of Canada (NBCC): Clause 1.2.1.1 of Division A and Clauses 4.1, 4.3.1.1, and 9.23 of Division B
   - CSA O86-14 (Reprinted May 2016) Engineering Design in Wood
   - ASTM D5456-14b recognized by CSA O86-14
   - APA PRR-401 Performance Standard for APA EWS Rim Boards
   - PFS Corporation Test Reports (Louisiana-Pacific Corporation, Golden, BC): 1750F_b - 1.3E, 2250F_b - 1.5E Douglas-fir LVL, 2250F_b - 1.5E Lodgepole pine LVL, 2650F_b - 1.9E Douglas-fir LVL, 2650F_b - 1.9E Lodgepole pine LVL, 2950F_b - 2.0E Douglas-fir LVL
   - APA Reports T2005P-76A, T2006P-06, T2006P-25, T2006P-26, T2007P-89, T2008P-10, T2008P-13, T2008P-31, T2008P-39, T2008P-43, T2008P-46A, T2008P-49A, T2008P-55, T2008P-66, T2008P-85, T2008P-86, T2008P-94, T2008P-106, T2008P-112, T2008P-113, T2009P-04, T2009P-05, T2009P-12, T2009P-13, T2009P-25, T2009P-26, T2009P-64, T2009P-84, T2010P-14, T2010P-16, T2010P-18, T2010P-19, T2010P-24, T2010P-25, T2011Q-14, T2011P-24, T2011P-30, T2011P-68, T2012P-08, T2012P-20, T2013P-15, T2013P-17, T2013P-19, T2014-16, T2014P-26(A), T2014P-27(A), T2014P-28, and T2014P-48, and T2017P-09, and other qualification data

2. Product description:

2.1 LP SolidStart LSL

LP SolidStart LSL is made with strands of various species and strand classifications in accordance with the in-plant manufacturing standard approved by APA.

The LSL may be treated with zinc borate for decay and termite resistance to a retention level equivalent to that specified in American Wood Protection Association (AWPA) Standard T1 for Use Category 2 (UC2). When treated, the LSL is designated as LP SolidGuard® LSL. The efficacy of the preservative treatment of the LP SolidGuard LSL is outside the scope of this report and the APA certification program. For the purposes of this report, the designations of LP SolidStart LSL and LP SolidGuard LSL can be used interchangeably.

LP SolidStart LSL is available with thicknesses up to 133 mm (5-1/4 inches), and a range of widths and lengths. Refer to the manufacturer's technical guide (www.lpcorp.com/resources/product-literature) and a local LP Engineered Wood Products distributor for product availability.

LP SolidStart LSL can also be used as Part 9 wall framing in accordance with Clause 9.23.10 of the 2015 NBC and in Part 4 engineered wall systems subjected to limitations specified in this report. The minimum thickness of the LSL for wall framing is 38 mm (1-1/2 inches).

LP SolidStart LSL may be used as rim board with a minimum thickness of 29 mm (1-1/8 inches).

2.2 LP SolidStart LVL

LP SolidStart LVL is made with wood veneers laminated with grain parallel to the length of the member in accordance with the in-plant manufacturing standard approved by APA. LP SolidStart LVL is available with thicknesses up to 89 mm (3-1/2 inches), and a range of widths and lengths. LP SolidStart LVL "Billet Beams" are fabricated by face-laminating primary thicknesses, and are available in thicknesses of 89, 133 or 178 mm (3-1/2, 5-1/4 or 7 inches). Refer to the manufacturer's technical guide (see link above) and a local LP Engineered Wood Products distributor for product availability.

LP SolidStart LVL having a grade of 1.5E or greater can also be used as Part 9 wall framing in accordance with Clause 9.23.10 of the 2015 NBC and in Part 4 engineered wall systems subjected to limitations specified in this report. The minimum thickness of the LVL for wall framing is 38 mm (1-1/2 inches).

LP SolidStart LVL Rim Board is LP LVL with two or more veneers oriented 90 degrees (cross-ply) to the length. LP LVL Rim Board is available with a minimum thickness of 32 mm (1-1/4 inches), and may be used for all applications applicable to LP LVL except wall framing.

3. Design properties:

Table 1 lists the Limit States Design properties; Table 2 lists the equivalent relative densities for connection design; Table 3 lists the rim board factored resistances; and Table 4 lists the minimum fastener spacing for LP SolidStart LSL and LVL.

3.1 Beams, headers, and columns:

The allowable loads for LP SolidStart LSL and LVL beams, headers, and columns shall be in accordance with the recommendations provided by the manufacturer (see link above).

3.2 Wall framing:

LP SolidStart LVL having a grade of 1.5E or greater, and LP SolidStart LSL shall be permitted for use as wall studs in accordance with the prescriptive requirements of Part 9 of the 2015 NBC. The specified shear strength for nailed structural panel shear walls utilizing LP SolidStart LVL having a grade of 1.5E or greater shall be determined in accordance with Clause 11.3 of CSA O86 utilizing a Species Factor for Framing Material (J_{sp}) of 0.9.

3.2.1 Part 9 Stud Wall Applications: LP SolidStart LVL having a grade of 1.5E or greater, and LP SolidStart LSL used as studs are permitted in accordance with Clause 9.23.10 of the 2015 NBC, the conditions specified in Section 4.3 of this report, and the following requirements:

a) Braced wall panels utilizing LP SolidStart LSL and LVL studs are subject to the limitations in Clause 9.23.1.1 of the 2015 NBC, as applicable,
b) Fasteners for sheathing shall conform to Tables 9.23.3.5.-A and 9.23.3.5.-B of the 2015 NBC,
c) LP SolidStart LSL and LVL stud size and spacing shall conform to Table 9.23.10.1 of the 2015 NBC, and
d) LP SolidStart LSL and LVL stud-braced walls shall be detailed in accordance with Clause 9.23.13 of the 2015 NBC and Section 4.3 of this report.

3.2.2 Part 4 Stud Wall Applications: LP SolidStart LVL having a grade of 1.5E or greater, and LP SolidStart LSL shall be permitted when designed in accordance with Clause 4.3.1 of the 2015 NBC, the recommendations provided by the manufacturer (see link above), the conditions specified in Section 4.3 of this report, and the following requirements:

a) Blocked shear walls with LP SolidStart LSL and LVL studs can be used as lateral load resisting systems in wood construction in Canada with no height limitation. Unblocked shear walls are limited to a height of 4.9 m (16 feet) in accordance with Clause 11.4.4 of CSA O86-14.
b) Blocked shear walls shall be used in high seismic zones (i.e., Part 4, where $I_E F_a S_a(0.2) \geq 0.35$, and Part 9, where $S_a(0.2) \geq 0.7$ in the 2015 NBC).
c) For double-sided walls:
    1) LP SolidStart LSL studs shall be a minimum nominal 2x6 for connections with 10d nails spaced less than 100 mm (4 inches).
    2) LP SolidStart LVL studs shall be a minimum nominal 2x6 for connections with 8d nails and a minimum nominal 2x8 for connections with 10d nails at any nail spacing of 76 mm (3 inches).
    3) Stud size and sheathing attachment shall be in accordance with Clause 11.5.3.5 of CSA O86-14.
d) The nail diameter for sheathing-to-framing connections in any wall shall not exceed 3.7 mm (0.146 inch).
e) The nail spacing in any case shall be equal to or greater than 76 mm (3 inches).
f) The size of the nail heads shall meet the requirement specified in CSA B111.
g) Maximum sheathing thickness shall not exceed 15.8 mm (5/8 inch).
h) The stud spacing shall not exceed 610 mm (24 inches) on center.
i) The 64-mm (2.5-inch) stud or double 38-mm (1.5 inches) stud requirements outlined in Clause 11.5.3.5 of CSA O86-14 shall be applied. The double wall studs shall be constructed by joining single studs by a sufficient number of either nails or screws. The connection between plies shall be designed with mechanical fasteners to resist the shear force at the stud interface and prevent separation of the studs.

4. Product installation:

4.1 Beams and headers:
LP SolidStart LSL and LVL shall be installed in accordance with the recommendations provided by the manufacturer (see link above). Permissible details and allowable hole sizes shall be in accordance with the recommendations provided by the manufacturer.

4.2 Columns:

4.2.1 LP SolidStart LSL and LVL used as free-standing columns shall not be drilled or notched without the approval of a professional engineer or the manufacturer. Bolts, lag screws, and self-tapping screws shall only be inserted through the face of the column, perpendicular to the face of the strands in LP SolidStart LSL and the veneers in LP SolidStart LVL.

4.2.2 Built-up columns: When used for built-up columns, LP SolidStart LSL and LVL shall be constructed using connections specified by the manufacturer (see link above).

4.3 Wall framing:

4.3.1 Part 9 Stud Wall Applications: Cutting, notching, and boring of LP SolidStart LSL and LVL used as studs is permitted in accordance with Clause 9.23.5.3 of the 2015 NBC with the exception that the notch shall not exceed 25% of the stud depth. Stud wall nailing restrictions and requirements are presented in Section 4.3.3 of this report.

4.3.2 Part 4 Engineered Stud Wall Applications: Design for cutting, notching, and boring of LP SolidStart LSL and LVL shall be based on the recommendations provided by the

manufacturer (see link above), a net section analysis in accordance with the provisions of CSA O86, and the following:

a) The factored resistance for bending, axial compression, and axial tension shall be reduced by the Strength Reduction Factors, as specified in Table 5 of this report, to account for stress concentrations.
b) Hole size shall not exceed 40% of the stud depth.
c) The edge distance for holes shall have a minimum clear distance of 16 mm (5/8 inch) for stud depth of 140 mm (5-1/2 inches) and less. For larger studs, the minimum edge distance shall be 12% of the stud depth.
d) Notch depth shall not exceed 25% of the stud depth. The notch length shall not exceed 203 mm (8 inches).
e) Holes or notches shall not be placed with 152 mm (6 inches) of either end of the stud.
f) Holes and notches shall not be placed in the same cross-section. A clear vertical separation of at least twice the length of the notch or twice the diameter of the hole shall be maintained, whichever is greater.
g) Stud wall nailing restrictions and requirements are prescribed in Section 4.3.3 of this report.

4.3.3 Stud wall nailing restrictions and requirements

a) LP SolidStart LSL Studs
   - For sheathing attached with 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) with a spacing no closer than 152 mm (6 inches) on center, a single LP SolidStart LSL stud shall be permitted for framing at adjoining panel edges. Nails shall be installed a minimum 10 mm (3/8 inch) from all panel edges.
   - For sheathing attached with 3.3 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) or smaller with a spacing no closer than 102 mm (4 inches) on center, a single LP SolidStart LSL stud shall be permitted for framing at adjoining panel edges. Nails shall be installed a minimum 10 mm (3/8 inch) from all panel edges.
   - For sheathing attached with 3.3 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) spaced closer than 102 mm (4 inches) on center or 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) spaced closer than 152 mm (6 inches) on center, a double, stitch-nailed, LSL stud or single 64 mm (2-1/2 inch) thick LSL stud is required at adjoining panel edges. Nails shall be installed a minimum 10 mm (3/8 inch) from all panel edges and shall be staggered a minimum of 6 mm (1/4 inch) for each row of nails.

b) LP SolidStart LVL Studs
   - For sheathing attached with 3.3 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) or smaller with a spacing no closer than 152 mm (6 inches) on center, a single LP SolidStart LVL stud shall be permitted for framing at adjoining panel edges. Nails shall be installed a minimum 10 mm (3/8 inch) from all panel edges. 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) are not allowed where a single LP SolidStart LVL stud is used at adjoining panel edges.
   - For sheathing attached with 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches) spaced no closer than 102 mm (4 inches) on center or 3.3 mm x 64 mm nails (8d common: 0.131 inch x 2-1/2 inches) spaced no closer than 76 mm (3 inches) on center a double, stitch-nailed, LVL stud or single 64 mm (2-1/2 inch) thick LVL stud is required at adjoining panel edges. Nails shall be installed a minimum 13 mm (1/2 inch) from all panel edges and shall be staggered a minimum of 6 mm (1/4 inch) for each row of nails.

c) For Part 9 Stud Wall Applications: Double LSL and LVL studs shall be stitch-nailed together with 2 staggered rows of nails [minimum 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches)] spaced 203 mm (8 inches) in each row.

d) For Part 4 Engineered Stud Wall Applications: The stitch nailing of double LSL and LVL studs shall be designed to transfer the required lateral shear using an equivalent relative density of 0.50.

e) Nails into the edge of LSL and LVL studs shall not be spaced closer than 76 mm (3 inches) on center.

f) Maximum nail size is 3.8 mm x 76 mm nails (10d common: 0.148 inch x 3 inches).

4.4 Rim board:

4.4.1 LP SolidStart LSL and LVL rim boards shall be installed in accordance with the recommendations provided by the manufacturer (see link above) and the code.

5. Fire-rated assemblies:
Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer and approved by the authority having jurisdiction (AHJ), and the following requirements:

a) The applied factored compressive stress parallel to grain shall not exceed 4.4 MPa (640 psi) for LP SolidStart LSL and 5,5 MPa (800 psi) for LP SolidStart LVL.

b) When the slenderness ratio, C_C, exceeds 33, the factored resistance, ϕf_c, determined in accordance with Clause 15.3.3.4 of CSA O86-14, shall be multiplied by 0.77 for LP SolidStart LSL and 0.63 for LP SolidStart LVL.

6. Limitations:

a) LP SolidStart LSL and LVL shall be designed in accordance with the code using the design properties specified in this report.

b) LP SolidStart LSL and LVL is limited to dry service conditions, as defined in CSA O86, at which the average equilibrium moisture content of solid-sawn lumber over a year is 15 percent or less and does not exceed 19 percent.

c) LP SolidStart LSL and LP SolidGuard LSL are produced by Louisiana-Pacific Corporation facility in Houlton, Maine under a quality assurance program audited by APA.

d) The efficacy of the preservative treatment of the LP SolidGuard LSL is outside the scope of this report and the APA certification program.

e) LP SolidStart LVL is produced at the Louisiana-Pacific Corporation facilities in Wilmington, North Carolina, Golden, British Columbia, Canada and the Murphy Engineered Wood Division facilities in Sutherlin, Oregon under a quality assurance program audited by APA. A list of the LVL grades manufactured at different LP and Murphy facilities is maintained by APA for independent auditing purposes.

f) This report is subject to re-examination in one year.

7. Identification:
The LP SolidStart LSL and LVL described in this report are identified by a label bearing the manufacturer's name (Louisiana-Pacific Corporation) and/or trademark, the APA assigned plant number (1092 for the Houlton plant, 1071 for the Wilmington plant, 1066 for the Golden plant, and 1089 for the Sutherlin plant), the product type and grade, the APA logo, the report number PR-L280, and a means of identifying the date of manufacture.

Table 1. Specified Strengths and MOE (Limit States Design for Use in Canada) for LP SolidStart LSL and LVL [a,b]

Property		Specified Strengths and MOE for Limit States Design, MPa (psi)										
		LP SolidStart LSL			LP SolidStart LVL Rim Board (cross-ply)	LP SolidStart LVL						
		1.35E	1.55E	1.75E	1750F_b-1.3E	2250F_b-1.5E	2400F_b-1.7E	2650F_b-1.9E	2900F_b-2.0E	2950F_b-2.0E	3100F_b-.2.1E	3100F_b-2.2E
Bending (f_b), MPa (psi)	Joist	22.05[c] (3,195)	30.05[c] (4,360)	31.85[c] (4,620)	22.30[d] (3,234)	28.67[e] (4,158)	30.58[e] (4,435)	33.77[e] (4,897)	36.95[e] (5,359)	37.59[e] (5,452)	39.50[e] (5,729)	39.50[e] (5,729)
	Plank	24.35 (3,530)	33.40 (4,840)	35.64 (5,170)	22.30 (3,234)	28.03[f] (4,066)	29.31[f] (4,250)	33.13[f] (4,805)	37.59[f] (5,452)	37.59[f] (5,452)	39.50[f] (5,729)	37.59[f] (5,452)
Tension parallel to grain (f_t), MPa (psi)		13.95[g] (2,020)	18.70[g] (2,715)	22.47[g] (3,260)	12.38[i] (1,796)	13.93[h,i] (2,021)	13.93[i] (2,021)	16.51[h,i] (2,395)	18.58[h,i] (2,694)	18.58[h,i] (2,694)	18.58[h,i] (2,694)	18.58[h,i] (2,694)
Longitudinal shear (f_v), MPa (psi)	Joist	5.25 (760)	5.25 (760)	5.25 (760)	3.20 (465)	3.65 (530)	3.65 (530)	3.65 (530)	3.65 (530)	3.72 (540)	3.72 (540)	3.72 (540)
	Plank	2.00 (290)	2.00 (290)	2.00 (290)	1.79 (260)	1.79 (260)	1.79 (260)	1.79 (260)	1.79 (260)	1.79 (260)	1.79 (260)	1.79 (260)
Compression parallel ($f_{c\|\|}$), MPa (psi)		18.15 (2,635)	23.90 (3,470)	26.95 (3,910)	18.71 (2,713)	25.86 (3,751)	25.86 (3,751)	25.86 (3,751)	35.21 (5,107)	35.21 (5,107)	35.21 (5,107)	35.21 (5,107)
Compression perpendicular ($f_{c\perp}$), MPa (psi)	Joist	9.40 (1,365)	11.00 (1,595)	11.95 (1,730)	8.53 (1,238)	9.41 (1,365)	9.41 (1,365)	9.41 (1,365)	9.41 (1,365)	9.41 (1,365)	9.41 (1,365)	9.41 (1,365)
	Plank[l]	8.55 (1,240)	9.69 (1,405)	11.10 (1,610)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)	6.90 (1,001)
Modulus of Elasticity (E), MPa (psi)	Joist	9,310[j] (1.35 x10^6)	10,690[j] (1.55 x10^6)	12,070[j] (1.75x10^6)	8,960[j] (1.30x10^6)	10,340[j] (1.50x10^6)	11,720[j] (1.70x10^6)	13,100[k] (1.90x10^6)	13,790[j] (2.00x10^6)	13,790[k] (2.00x10^6)	14,480[j] (2.10x10^6)	15,170[j] (2.20x10^6)
	Plank	9,310[j] (1.35x10^6)	10,690[j] (1.55x10^6)	12,070[j] (1.75x10^6)	8,960[j] (1.30x10^6)	9,650[j] (1.4 x10^6)	11,720[j] (1.70x10^6)	12,4101[k] (1.80x10^6)	13,790[j] (2.00x10^6)	13,790[k] (2.00x10^6)	13,790[j] (2.00x10^6)	15,170[j] (2.20x10^6)

[a] The tabulated values are specified strengths and modulus of elasticity for standard-term load duration. All values, except for E, are permitted to be adjusted for other load durations as permitted by the code. The tabulated values are limited to dry service conditions.

[b] The tabulated values for "Joist" refer to loads applied parallel to the wide face of the strands (the edge of the member). "Plank" refers to loads applied perpendicular to the wide face of the strands (the face of the member).

[c] The tabulated values for LP SolidStart LSL are based on a reference depth of 305 mm (12 inches). For other depths, when loaded edgewise, the specified bending strength (f_b) shall be modified by $(^{305}/_{d})^{0.120}$, where d = depth in mm. For depths less than 89 mm (3-1/2 inches), the factor for the 89-mm (3-1/2-inch) depth shall be used.

[d] The tabulated value for LP LVL Rim Board (with cross plies) is based on a reference depth of 305 mm (12 inches). For other depths, when loaded edgewise, the specified bending strength (f_b) shall be modified by $(12/d)^{0.261}$, where d = depth in mm. For depths less than 89 mm (3-1/2 inches), the factor for the 89-mm (3-1/2-inch) depth shall be used.

[e] The tabulated values for LP SolidStart LVL are based on a reference depth of 305 mm (12 inches). For depths greater than 305 mm (12 inches), multiply f_b by $(12/d)^{0.143}$, where d = depth in mm. For depths less than 305 mm (12 inches), multiply f_b by $(12/d)^{0.111}$, where d = depth in mm. For depths less than 89 mm (3-1/2 inches), the factor for the 89-mm (3-1/2-inch) depth shall be used.

[f] For LP SolidStart LVL "Billet Beams" up to 178 mm (7 inches) in thickness (see Section 2.2), the specified bending strength (f_b) in plank orientation shall be modified by $(^{1.75}/_{d})^{0.25} \leq 1.0$, where d = depth in mm.

(g) The tabulated values for LP SolidStart LSL are based on a reference length of 6,096 mm (20 feet). For other lengths, the specified tensile strength (f_t) shall be modified by $(6{,}096/\ell)^{0.092}$, where ℓ = length in mm. For lengths less than 914 mm (3 feet), the factor for the length of 914 mm (3 feet) shall be used.

(h) For LP SolidStart LVL 38 mm (1-1/2 inches) in thickness, the specified tensile strength (f_t) is as follows:

LP SolidStart LVL Grade	2250F_b-1.5E	2650F_b-1.9E	2900F_b-2.0E and higher
f_t (38-mm or 1-1/2-inch thick LVL), MPa (psi)	18.06 (2,620)	19.35 (2,807)	21.68 (3,144)

(i) The values for LP SolidStart LVL published in Table 1 and Footnote (h) are based on a reference length of 6,096 mm (20 feet). For other lengths, the allowable tensile strength (f_t) shall be modified by $(6{,}096/\ell)^{0.092}$, where ℓ = length in mm. For lengths less than 914 mm (3 feet), the factor for the length of 914 mm (3 feet) shall be used.

(j) The tabulated modulus of elasticity is the shear-free MOE. For uniformly loaded simple-span beams, deflection is calculated as follows:

$$\text{In Metric Units:}\quad \delta = \frac{156.3\,w\,L^4}{E\,b\,d^3}\times 10^6 + \frac{2400\,w\,L^2}{E\,b\,d}$$

Where: δ = estimated deflection, mm; w = uniform load, N/m; L = span, m; E = modulus of elasticity, MPa; b = beam width, mm; d = beam depth, mm

or

$$\text{In Imperial Units:}\quad \delta = \frac{270\,w\,L^4}{E\,b\,d^3} + \frac{28.8\,w\,L^2}{E\,b\,d}$$

Where: δ = estimated deflection, inches; w = uniform load, plf; L = span, feet; E = tabulated modulus of elasticity, psi; b = beam width, inches, and; d = beam depth, inches

(k) The tabulated modulus of elasticity is the apparent MOE, which includes the effects of shear deformation. When calculating deflection, standard engineering formulae for pure bending deflection are sufficient, and the second terms of the equations in Footnote (j) may be ignored.

(l) The size factor for bearing, K_{Zcp}, shall be equal to 1.0.

Table 2. Fastener Details for LP SolidStart LSL and LVL[a,b,c]

Equivalent Relative Density (G)					
Nails		Nails and Wood Screws		Bolts and Lag Screws[d,e]	
Withdrawal Load		Lateral Load		Lateral Load	
Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Installed in Face	
				Parallel to Grain	Perpendicular to Grain
LP SolidStart LSL					
0.46	0.50	0.50	0.55	0.50	0.58
LP SolidStart LVL Rim Board (cross-ply)					
0.46	0.50	0.50	0.50	0.46	0.50
LP SolidStart LVL					
0.46[f]	0.50	0.50	0.50	0.46[g]	0.50

[a] Fastener types and orientation not specifically described above are beyond the scope of this report.
[b] Fastener values determined using the equivalent relative densities in this table are for standard-term load duration and are permitted to be adjusted for other load durations as permitted by the code.
[c] Fastener spacing, and end and edge distances shall be as specified in CSA O86, except that nail spacing and end distance shall be as specified in Table 4.
[d] Bolts and lag screws shall only be installed into the face (plank orientation) of the LSL and LVL.
[e] The capacities for 12.7 mm (1/2 inch) diameter lag screws installed into LP SolidStart LSL and LVL Rim Board for ledge attachment shall be in accordance with Table 3.
[f] The equivalent relative density is permitted to be increased to 0.49 for LVL manufactured from the Sutherlin plant (Mill number 1089).
[g] The equivalent relative density is permitted to be increased to 0.50 for LVL manufactured from the Sutherlin plant (Mill number 1089).

Table 3. Factored Resistances for LP SolidStart LSL and LVL Rim Boards[a]

Grade	Thickness, mm (in.)	Lateral Load[b,c], kN/m (lbf/ft)	Vertical Uniform Load[d], kN/m (lbf/ft)		Vertical Concentrated Load, kN (lbf)	Lateral Resistance for 13-mm (1/2-inch) dia. Lag Screws, kN (lbf)
			Depth ≤ 406 mm (16 inches)	406 mm (16 inches) < Depth ≤ 610 mm (24 inches)[e]	Depth ≤ 610 mm (24 inches)[e]	
LP SolidStart LSL						
1.35E and above	29 (1-1/8)	3.81 (261)	118 (8,090)	NA	26.0 (5,838)	2.97 (667)
	32 (1-1/4)	4.76 (326)	146 (10,008)	92.5 (6,338)	28.2 (6,338)	3.34 (751)
	≥ 38 (≥ 1-1/2)	5.33 (365)	170 (11,676)	110 (7,506)	33.4 (7,506)	3.52 (792)
LP SolidStart LVL Rim Board (cross-ply)						
1750F_b-1.3E	≥ 32 (≥ 1-1/4)	4.76 (326)	228 (15,596)	123 (8,457)	31.2 (7,022)	3.34 (751)
LP SolidStart LVL						
1.5E and above	38 ≤ t < 44 (1-1/2 ≤ t <1-3/4)	4.76 (326)	97.4 (6,672)	60.9 (4,170)	20.0 (4,504)	3.34 (751)
	t ≥ 44 (t ≥ 1-3/4)	4.76 (326)	110 (7,506)	84.0 (5,755)	23.7 (5,338)	3.34 (751)

[a] The tabulated lateral load factored resistance is based on the short-term load duration. The vertical uniform and vertical concentrated load are not permitted to be increased for any load durations. The tabulated values are limited to dry service conditions.
[b] The horizontal lateral load transfer resistance is for shear forces parallel to the rim joist under short-term loading and dry service conditions only. The fastening of the floor shall meet or exceed Part 9 of the 2015 NBC.
[c] The nailing schedule for sheathing to rim is based on 51 mm (6d, 2 inches) nails at 150 mm (6 inches) on center and for rim board to sill plate (toe-nailed) is based on 64 mm (8d, 2-1/2 inches) nails at 150 mm (6 inches) on center. Values assume that floor joists or blocking are fastened to the rim board and sill plate at a maximum of 610 mm (24 inches) on center in accordance with Part 9 of the 2015 NBC. Commercial framing connectors may be used to achieve lateral load capacities exceeding the values shown in this table. Calculations shall be based on the equivalent relative density values listed in Table 2 subjected to the nailing spacing provided in Table 4.
[d] The factored vertical uniform load capacity is based on the strength of the rim board and may need to be reduced based on the bearing capacity of the supporting wall plate.
[e] 29 mm (1-1/8 inch) thick LP SolidStart LSL is limited to a maximum depth of 406 mm (16 inches) for rim board applications.

Table 4. Minimum Nail Spacings for LP SolidStart LSL and LVL[a]

Thickness, mm (in.)	Orientation[d]	Common Wire or Spiral Nail Size[e]	Minimum End Distance, mm (in.)	Minimum Nail Spacing per Row, mm (in.)	
				Single Row	Multiple Rows [b,c]
LP SolidStart LSL					
25 ≤ t < 32 (1 ≤ t < 1-1/4)	Edge[f]	64 mm (2-1/2 in.) (8d)	51 (2)	102 (4)	NA
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	51 (2)	102 (4)	
		89 mm (3-1/2 in.) (16d)	NA[h]	NA[h]	
	Face[g]	64 mm (2-1/2 in.((8d)	22 (7/8)	25 (1)	25 (1)
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	22 (7/8)	25 (1)	25 (1)
		89 mm (3-1/2 in.) (16d)	22 (7/8)	38 (1-1/2)	38 (1-1/2)
32 ≤ t < 38 (1-1/4 ≤ t < 1-1/2)	Edge[f]	64 mm (2-1/2 in.) (8d)	51 (2)	102 (4)	NA
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	51 (2)	102 (4)	
		89 mm (3-1/2 in.) (16d)	64[i] (2-1/2)	127[j] (5)	
	Face[g]	64 mm (2-1/2 in.((8d)	22 (7/8)	25 (1)	25 (1)
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	22 (7/8)	25 (1)	25 (1)
		89 mm (3-1/2 in.) (16d)	22 (7/8)	38 (1-1/2)	38 (1-1/2)
38 ≤ t < 45 (1-1/2 ≤ t < 1-3/4)	Edge[f]	64 mm (2-1/2 in.) (8d)	51 (2)	76 (3)	76 (3)
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	51 (2)	76 (3)	102 (4)
		89 mm (3-1/2 in.) (16d)	64[i] (2-1/2)	102 (4)	152 (6)
	Face[g]	64 mm (2-1/2 in.((8d)	22 (7/8)	25 (1)	25 (1)
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	22 (7/8)	25 (1)	25 (1)
		89 mm (3-1/2 in.) (16d)	22 (7/8)	38 (1-1/2)	38 (1-1/2)
≥ 45 (≥ 1-3/4)	Edge[f]	64 mm (2-1/2 in.) (8d)	51 (2)	76 (3)	76 (3)
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	51 (2)	76 (3)	102 (4)
		89 mm (3-1/2 in.) (16d)	64[i] (2-1/2)	76 (3)	152 (6)
	Face[g]	64 mm (2-1/2 in.) (8d)	22 (7/8)	25 (1)	25 (1)
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	22 (7/8)	25 (1)	25 (1)
		89 mm (3-1/2 in.) (16d)	22 (7/8)	38 (1-1/2)	38 (1-1/2)
LP SolidStart LVL					
< 38 (< 1-1/2)	Edge[f]	64 mm (2-1/2 in.) (8d)	64 (2-1/2)	102 (4)	NA
		76 mm (3 inch) (10d) & 83 mm (3-1/4 in.) (12d)	64 (2-1/2)	102 (4)	
		89 mm (3-1/2 in.) (16d)	89 (3-1/2)	127 (5)	
	Face[g]	64 mm (2-1/2 in.) (8d)	38 (1-1/2)	76 (3)	76 (3)
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	38 (1-1/2)	76 (3)	76 (3)
		89 mm (3-1/2 in.) (16d)	38 (1-1/2)	127 (5)	127 (5)
≥ 38 (≥ 1-1/2)	Edge[f]	64 mm (2-1/2 in.) (8d)	64 (2-1/2)	76 (3)	102[k] (4)
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	64 (2-1/2)	102 (4)	127[k] (5)
		89 mm (3-1/2 in.) (16d)	89 (3-1/2)	127 (5)	152[k,l] (6)
	Face[g]	64 mm (2-1/2 in.) (8d)	38 (1-1/2)	76 (3)	76 (3)
		76 mm (3 in.) (10d) & 83 mm (3-1/4 in.) (12d)	38 (1-1/2)	76 (3)	76 (3)
		89 mm (3-1/2 in.) (16d)	38 (1-1/2)	127 (5)	127 (5)

(Footnotes on following page)

(a) Edge distance shall be sufficient to prevent splitting, but not less than permitted in CSA O86.
(b) Multiple rows shall be spaced 13 mm (1/2 inch) or more from each other and offset one-half of the tabulated minimum nail spacing, as shown in Figure 1.
(c) Multiple rows shall be equally spaced about the centerline of the edge or face (whichever applies).
(d) Face orientation applies to nails driven into the face of the LSL or LVL member, such that the long axis of the nail is perpendicular to the wide faces of the strands or veneers. Edge orientation applies to nails driven into the edge of the LSL or LVL member.
(e) The tabulated minimum end distance and nail spacing requirements are based on common wire nails. For nails with smaller diameters, the spacing and end distance requirements of the common wire nail with the next larger diameter may be used: e.g., a 76 mm (3 inch) nail with a diameter 3.05 mm (0.120 inches) may be spaced the same as a 64 mm (2-1/2 inch) common wire nail with a diameter of 3.25 mm (0.128 inches). Larger nail sizes and shank types not specifically described above are beyond the scope of this report.
(f) Nail penetration for edge nailing shall not exceed 51 mm (2 inches) for 89 mm (3-1/2 inch (16d common)) nails and 64 mm (2-1/2 inches) for all nails with a smaller shank diameter.
(g) Tabulated closest on-center spacing for face orientation is applicable to nails that are installed in rows parallel to the grain (length) of the LSL or LVL. For nails installed in rows perpendicular to the direction of grain (width/depth) of the LSL or LVL, the closest on-center spacing for face orientation shall be sufficient to prevent splitting of the LSL or LVL.
(h) For LSL thicknesses of 29 mm (1-1/8 inches) or greater, 89 mm (16d common) nails are permitted to be driven into the edge, with a minimum end distance of 64 mm (2-1/2 inches) and a minimum spacing of 127 mm (5 inches). For LSL thicknesses less that 29 mm (1-1/8 inches), 89 mm (16d common) nails are not permitted to be driven into the edge.
(i) Minimum end distance may be reduced to 51 mm (2 inches) when the nail penetration into the edge of the LSL does not exceed 35 mm (1-3/8 inches).
(j) Minimum end distance may be reduced to 102 mm (4 inches) when the nail penetration into the edge of the LSL does not exceed 35 mm (1-3/8 inches).
(k) Minimum nail spacing is tabulated for LVL manufactured from the Sutherlin plant (Mill number 1089). The minimum nail spacing may be reduced by 25 mm (1 inch) for LVL manufactured from the Wilmington and Golden plants (Mill numbers 1077 and 1066).
(l) Minimum nail spacing may be reduced by 25 mm (1 inch) for 44-mm (1-3/4-inch) thick (or greater) LVL manufactured from the Sutherlin plant (Mill number 1089).

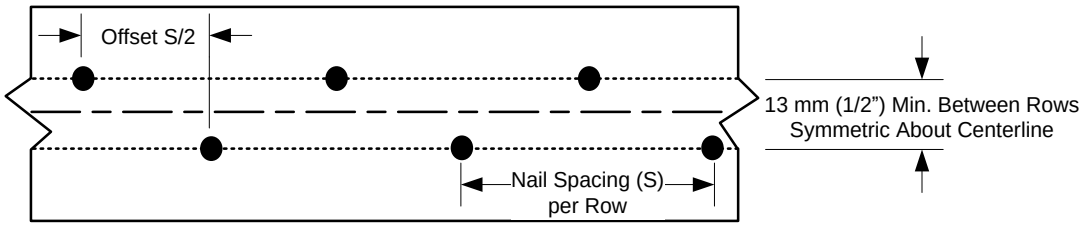

Figure 1. Spacing of multiple rows of nails.

Table 5. Strength Reduction Factors for Notches and Holes in LP SolidStart LSL and LVL Studs[a,b,c]

Material	Notches			Holes		
	Bending	Compression	Tension	Bending	Compression	Tension
LP LSL	0.95	0.90	0.75	1.00	1.00	1.00
LP LVL	0.80	0.90	0.60	0.95	0.95	0.95

(a) Design of LP LSL and LP LVL studs with notches and holes used in engineered wall framing shall be based on a net-section analysis in accordance with the CSA O86. See Section 4.3.2 of this report for limitations on the maximum size and placement of notches and holes.
(b) The factored resistances for bending, compression and tension shall be multiplied by the strength reduction factors in the above table.
(c) See Section 4.3 for notching and boring of holes in LP LSL and LP LVL studs used in wall framing.

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APA – THE ENGINEERED WOOD ASSOCIATION
HEADQUARTERS
7011 So. 19th St. ▪ Tacoma, Washington 98466
Phone: (253) 565-6600 ▪ Fax: (253) 565-7265 ▪ Internet Address: www.apawood.org

PRODUCT SUPPORT HELP DESK
(253) 620-7400 ▪ *E-mail Address*: help@apawood.org

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