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Joint Evaluation Report

ESR-2403

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 13—Laminated Veneer Lumber
Section: 06 17 25—Laminated Strand Lumber

REPORT HOLDER

LOUISIANA–PACIFIC CORPORATION

ADDITIONAL LISTEE:

BOISE CASCADE WOOD PRODUCTS, LLC

MURPHY ENGINEERED WOOD DIVISION

EVALUATION SUBJECT:

LP® SOLIDSTART® LAMINATED STRAND LUMBER (LSL), LP® SOLIDGUARD® LAMINATED STRAND LUMBER (LSL) AND LP® SOLIDSTART® LAMINATED VENEER LUMBER (LVL)

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2018, 2015, 2012 and 2009 *International Building Code®* (IBC)
- 2018, 2015, 2012 and 2009 *International Residential Code®* (IRC)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LADBS), see ESR-2403 LABC and LARC Supplement.

Properties evaluated:

- Structural
- Fire resistance
- Preservative Treatment

2.0 USES

LP® SolidStart® laminated strand lumber (LSL) and laminated veneer lumber (LVL) are used for structural applications, such as beams, headers, joists, rafters, columns, wall studs, wall plates and rim board. They are also used as components in built-up structural members, such as flanges for I-joists and chords for trusses. LP® SolidStart® LVL is also used as laminations for glued-laminated members. LP® SolidStart® LSL may also be used as sill plates when treated (LP® SolidGuard® LSL).

3.0 DESCRIPTION

3.1 General:

The LP® SolidStart® LSL and LVL described in this report comply with the requirements noted in Section 2303.1.10 of the 2018 and 2015 IBC (2303.1.9 of the 2012 and 2009 IBC), for allowable stress design in accordance with the 2018 IBC Section 2302.1(1) and 2015, 2012 and 2009 IBC Section 2301.2(1). They may also be used in structures regulated under the IRC when an engineered design is submitted in accordance with IRC Section R301.1.3.

3.2 LP® SolidStart® LSL:

LP® SolidStart® LSL consists of wood strands bonded together using an exterior-type structural adhesive. The wood strand properties and species, adhesive, manufacturing parameters and finished product dimensions and tolerances are as specified in the approved quality documentation and manufacturing standard.

LP® SolidStart® LSL may be treated with zinc borate (ZB) for protection against decay and termites, and is limited to interior locations, continuously protected from the weather and not in contact with the ground, but may be subject to dampness (such as in sill plates over concrete footings and slabs) as defined by the American Wood Protection Association (AWPA) Use Category UC2 as defined in AWPA U1. When treated with ZB, LP® SolidStart® LSL is designated LP® SolidGuard® LSL. Unless noted otherwise within this report, all design provisions for LP® SolidStart® LSL apply also to LP® SolidGuard® LSL.

3.3 LP® SolidStart® LVL:

LP® SolidStart® LVL consists of layers of wood veneers laminated together using an exterior-type structural adhesive. The wood veneer properties and species, adhesive, manufacturing parameters and finished product dimensions and tolerances are as specified in the approved quality documentation and manufacturing standard.

LP® SolidStart® LVL "Billet Beam" is fabricated by face-laminating individual thicknesses of LP® LVL. "Billet beam" is available up to a maximum thickness of 7 inches (178 mm).

LP® SolidStart® LVL designated as "Rim Board" is LP® LVL with two or more veneers oriented 90 degrees (cross-ply) to the length. LP® LVL Rim Board may be used for all applications applicable to LP® LVL as defined in Section 2.0.

4.0 DESIGN AND INSTALLATION

4.1 General:

Design and installation of LP® SolidStart® LSL and LVL, including LP® SolidStart® LVL "Billet Beam", must be in accordance with this report, the applicable code provisions and the manufacturer's published installation instructions. The manufacturer's published installation instructions must be available at the jobsite at all times during installation. The

requirements specified for allowable stress design in accordance with the 2018 IBC Section 2302.1(1) and 2015, 2012 and 2009 IBC Section 2301.2(1), and the design provisions for structural composite lumber in the ANSI/AWC *National Design Specification* (NDS) *for Wood Construction*, are applicable to LP® SolidStart® LSL and LVL, except as modified within this report. Reference design values for each grade of LP® SolidStart® LSL and LVL are given in Table 1.

4.2 Connections:

The design of mechanical connections in LP® SolidStart® LSL and LVL must be in accordance with the NDS. Equivalent specific gravities for the design of nail, bolt and lag screw connections under dry use conditions are given in Table 2. Minimum nail spacing and end distance requirements are given in Table 3. Nailing requirements for the attachment of wall sheathing are given in Section 4.3.3.

Exception: Lag screw connections between LP® SolidStart® LSL and LVL rim board and lumber deck ledgers have allowable lateral loads as specified in Table 4, provided all of the following conditions are met:

1. Lag screws must have a minimum diameter of $^1/_2$ inch (12.7 mm), and sufficient length such that the lag screw shank penetrates through the rim board (not including the length of the tapered tip).
2. Deck ledgers must consist of lumber having a minimum thickness of 1.5 inches (38 mm) and a minimum assigned specific gravity of 0.42.
3. The sheathing between the rim board and the deck ledger must consist of wood structural panels meeting U.S. DOC PS-1 or PS-2, and be attached to the rim board in accordance with the applicable code.
4. One flat washer must be used between the deck ledger and the lag screw head.
5. Edge distances from the center of the lag screw to the edges of the rim board and deck ledger must be 2 inches (51 mm) or greater. End distances must be 4 inches (102 mm) or greater.
6. Adjustment factors in accordance with the NDS must be applied as applicable.
7. Rim board and deck ledgers must be checked for load-carrying capacity at connections in accordance with Section 11.1.2 of the 2018 and 2015 NDS (10.1.2 of the 2012 NDS and 2005 NDS).

4.3 Wall Studs:

Prescriptive Wall Framing: LP® SolidStart® LSL having a grade of 1.35E or greater, and LP® SolidStart® LVL having a grade of 1.5E or greater, are considered equivalent to sawn lumber studs for prescriptive wall framing applications in accordance with Section 2308.5 of the 2018 and 2015 IBC (2308.9 of the 2012 and 2009 IBC) and Section R602 of the IRC, subject to the following conditions:

1. LP® SolidStart® LSL and LVL studs must have a thickness of $1^1/_2$ inches (38 mm) or greater.
2. Cutting, notching, and boring of 3.5-inch-deep (89 mm) and 5.5-inch-deep (140 mm) LP® SolidStart® LSL and LVL studs used in prescriptive wall framing is permitted in accordance with Sections 2308.5.9 and 2308.5.10 of the 2018 and 2015 IBC (2308.9.10 and 2308.9.11 of the 2012 and 2009 IBC), and Section R602.6 of the IRC.
3. Connections between wall sheathing and LP® SolidStart® LSL and LVL framing must meet the requirements of Section 4.3.2.

4.3.1 Engineered Wall Framing: LP® SolidStart® LSL having a grade of 1.35E or greater, and LP® SolidStart® LVL having a grade of 1.5E or greater, may be used in engineered wall framing applications, subject to the following conditions:

1. LP® SolidStart® LSL and LVL studs are equivalent to sawn lumber studs with a maximum specific gravity of 0.50.
2. LP® SolidStart® LSL and LVL studs must have a thickness of $1^1/_2$ inches (38 mm) or greater.
3. Notching and boring of LP® SolidStart® LSL and LVL studs is permitted in engineered wall assemblies. The design must be based on net-section analysis in accordance with the NDS, and is subject to the following additional conditions and allowable stress reductions:
   a. Holes up to 40 percent of the depth of the stud are permitted anywhere along the stud length, except that a hole must not be placed within 6 inches (152 mm) of the end of the stud. A minimum edge distance, measured from the edge of the hole to the edge of the member, must be maintained for all holes as follows (see Figure 2):
      (1) $^5/_8$ inch (16 mm) for studs 5.5 inches deep (140 mm) or less, or
      (2) 12 percent of the stud depth for studs more than 5.5 inches deep (140 mm).
   b. Notches up to 25 percent of the depth of the stud are permitted anywhere along the stud length, except that a notch must not be placed within 6 inches (152 mm) of the end of the stud. The notch length must not exceed 8 inches (203 mm).
   c. Holes and notches must not be cut in the same cross section and must be separated by a clear, vertical distance of two times the larger of the hole diameter or the notch height, whichever is greater.
   d. The reference design stresses for bending, axial compression, and axial tension must be multiplied by a stress reduction factor to account for stress concentrations at notches and holes, as given in Table 5.
4. Connections between wall sheathing and LP® SolidStart® LSL or LVL framing must meet the requirements of Section 4.3.2.

4.3.2 Nailing Requirements: When LP® SolidStart® LSL and LVL members are used as wall studs, the sheathing-to-stud and stud-to-stud connections must meet the following requirements:

1. A single $1^1/_2$-inch-thick (38 mm) stud may be used for framing at adjoining panel edges for wall sheathing attached as follows:
   a. For LP® SolidStart® LSL: 10d common nails [3 inches (76 mm) by 0.148 inch (3.76 mm) in diameter] spaced no closer than 6 inches (152 mm) on center, or 8d common nails [$2^1/_2$ inches (64 mm) by 0.131 inch (3.33 mm) in diameter] spaced no closer than 4 inches (102 mm) on center. See Detail A in Figure 3.
   b. For LP® SolidStart® LVL: 8d common nails spaced

no closer than 6 inches (152 mm) on center; 10d common nails are not allowed where a single $1^1/_2$-inch-thick (38 mm) stud is used at adjoining panel edges. See Detail A in Figure 3.

2. A minimum $2^1/_2$-inch-thick (64 mm) single stud or a double $1^1/_2$-inch (38 mm) or thicker stud is required for framing at adjoining panel edges for wall sheathing attached as follows:
   a. For LP® SolidStart® LSL: 10d common or 8d common nails spaced no closer than 3 inches (76 mm) on center, and staggered a minimum of $^1/_4$ inch (6.4 mm) horizontally. See Detail B in Figure 3.
   b. For LP® SolidStart® LVL: 10d common nails spaced no closer than 4 inches (102 mm) on center, or 8d common nails spaced no closer than 3 inches (76 mm) on center, staggered a minimum of $^1/_4$ inch (6.4 mm) horizontally. See Detail B in Figure 3.
3. Where double studs are required at adjoining panel edges, they must be connected together as follows:
   a. For stud wall applications in accordance with the IRC and the conventional light-frame provisions of the Section 2308 of the IBC and Table 2304.10.1 of the 2018 and 2015 IBC (Table 2304.9.1 of the 2012 and 2009 IBC), double LP® SolidStart® LSL and LVL studs must be stitch-nailed together with a minimum of two staggered rows of 10d nails [$2^7/_8$ inches (73 mm) by 0.120 inch (3.05 mm) in diameter] spaced 8 inches (203 mm) on center in each row.
   b. For engineered stud wall applications, double LP® SolidStart® LSL and LVL studs must be stitch-nailed together with a connection designed to transfer the required lateral shear, using an assumed equivalent specific gravity of 0.50. When stitch-nailing two $1^3/_4$-inch-thick (44 mm) studs, 3-inch (76 mm) or longer nails are required.
   c. The stitch nails must be driven in two lines spaced approximately 1 inch (25 mm) from each stud edge.
4. Where double studs are required at adjoining panel edges, the panel-edge nails must be installed with a minimum $^1/_2$-inch (12.7 mm) edge distance from the panel edges, and staggered a minimum of $^1/_4$ inch (6.4 mm) horizontally within each line of nails. For LP® LSL, the minimum edge distance for panel-edge nails may be reduced to $^3/_8$ inch (9.5 mm).
5. The maximum allowable nail size for attaching wall sheathing to the edge of a stud is 10d common [3 inches (76 mm) by 0.148 inch (3.76 mm) in diameter].

4.3.3 Wall Plates: LP® SolidStart® LSL and LVL may be used as bottom (sole) plates and top plates, except where preservative-treated wood is required by Section 2304.12 of the 2018 and 2015 IBC (2304.11 of the 2012 and 2009 IBC) and Sections R317 and R318 of the 2018, 2015 and 2012 IRC (R319 and R320 of the 2009 IRC). LP® SolidGuard® LSL may be used as sill plates where preservative-treated wood is required but is limited to AWPA Use Category UC2 (Interior/Damp) as defined in AWPA U1. Stresses resulting from applied loads must not exceed the adjusted design values determined in accordance with Section 4.1 of this report.

4.4 Rim Board and Blocking:

When used as rim board, LP® SolidStart® LSL and LVL must be continuously supported across the full width (except as noted in Section 4.4.2), and must be located at the joist elevation either perpendicular to, or parallel to, the joist framing. It must be the full depth of the joist space and be used for any combination of the following:

- To transfer, from above to below, all vertical loads at the rim board location. Allowable vertical loads are given in Table 4.
- To provide diaphragm attachment (sheathing to top edge of rim board).
- To transfer in-plane lateral loads from the diaphragm to the wall plate below. Allowable in-plane lateral loads are given in Table 4.
- To provide lateral support to the joist or rafter (resistance against rotation) through attachment to the joist or rafter.
- To provide closure for ends of joists or rafters.
- To provide an attachment base for siding and/or an exterior deck ledger.

4.4.1 Rim **board** must be installed in accordance with the prescriptive provisions of the applicable code, and design loads must not exceed those given in Table 4.

4.4.2 Installation of LP® SolidStart® LSL and LVL rim board over wall openings is permitted, provided the rim board is designed for all applicable stresses in accordance with Sections 4.1 and 4.2 adjusted by the applicable adjustment factors. Joints in the rim board are not allowed within 12 inches (305 mm) of the opening.

4.4.3 LP® SolidStart® LSL and LVL having minimum thicknesses as given in Table 4 may be used as direct replacements for the nominally 2-inch-thick solid blocking specified in Section 2308.4.2.3 of the 2018 and 2015 IBC (2308.8.2 of the 2012 and 2009 IBC) and Section R502.7 of the IRC.

4.5 Fire Resistance and Fire Blocking:

4.5.1 Calculated Fire Resistance: The fire resistance of exposed LP® SolidStart® LSL and LP® SolidStart® LVL may be calculated in accordance with Chapter 16 of the NDS.

4.5.2 Fire-resistance-rated Floor and Roof Systems: LP® SolidStart® LSL having a grade of 1.35E or greater, and LP® SolidStart® LVL having a grade of 1.5E or greater, may be used as direct replacements for non-fire-retardant-treated sawn lumber, of equivalent size, in the prescriptive fire-resistance-rated floor and roof assemblies listed in Table 721.1(3) of the 2018, 2015 and 2012 IBC (Table 720.1(3) of the 2009 IBC).

4.5.3 Fire Protection of Floors: LP® SolidStart® LSL having a grade of 1.35E or greater, and LP® SolidStart LVL having a grade of 1.5E or greater, having a minimum thickness of $1^1/_2$ inches (38 mm) and a minimum depth of $9^1/_4$ inches (235 mm), is considered equivalent to lumber joists in accordance with Exception 4 to Section R302.13 of the 2018 and 2015 IRC (R501.3 of the 2012 IRC).

4.5.4 Fire-resistance-rated Wall Construction: LP® SolidStart® LSL and LVL wall studs described in Section 4.3 are permitted to be used in fire-resistance-rated wall construction as follows:

1. For conventional light-frame construction, LP® SolidStart® LSL and LVL may be used as direct replacements for non-fire-retardant-treated sawn lumber studs of equivalent size in the prescriptive fire-resistance-rated wall assemblies listed in Table 721.1(2) of the 2018, 2015 and 2012 IBC, and Table 720.1(2) of

the 2009 IBC, subject to the following conditions:

a. The stud must be $1^1/_2$ inches (38 mm) by $3^1/_2$ inches (89 mm) or greater in size.

b. Tape and joint compound must be applied to fastener heads and gypsum wallboard joints on exposed surfaces.

2. For engineered, load-bearing wall construction, LP® SolidStart® LSL and LVL are permitted to be used in 1-hour fire-resistance-rated wall assemblies meeting the following conditions:

a. The minimum stud size must be $1^1/_2$ inches (38 mm) by $3^1/_2$ inches (89 mm) or greater.

b. Studs must be spaced no more than 24 inches (610 mm) on center.

c. Minimum $^5/_8$-inch (15.9 mm) Type X gypsum wallboard must be attached with $2^1/_4$-inch-long (57 mm) Type S drywall screws spaced 7 inches (178 mm) on center along each stud.

d. Minimum 2.5 pcf (40 kg/m^3) mineral wool insulation must be placed in each stud cavity.

e. Tape and joint compound must be applied to fastener heads and gypsum wallboard joints on the exposed surface(s).

f. The design axial compressive stress within the studs must not exceed the least of the following:

i. 440 psi (3032 kPa) for LSL, and 550 psi (3790 kPa) for LVL.

ii. $0.77F_c'$ for LSL, and $0.63F_c'$ for LVL; where F_c' is the compression design value parallel-to-grain, adjusted by all applicable adjustment factors in accordance with the NDS, including the column stability factor, C_P.

iii. $0.77F_c'$ for LSL and $0.63F_c'$ for LVL; where F_c' is the compression design value parallel-to-grain, adjusted for all applicable adjustment factors in accordance with the NDS, and where C_P is evaluated at a slenderness ratio of 33.

g. The load-bearing capacity of 1.75E LSL used in fire-resistance-rated wall assemblies must be limited to the capacity of 1.55E LSL.

4.5.5 Fire Blocking: LP® SolidStart® LSL and LVL is permitted to be used as fire blocking in accordance with Section 718.2.1 of the 2018, 2015 and 2012 IBC (717.2.1 of the 2009 IBC) and Section R602.8 of the IRC as follows:

1. LP® SolidStart® LSL and LVL having a minimum thickness of $1^1/_4$ inches (31.8 mm) is permitted to be used as an alternate to nominally 2-inch lumber fire blocking.

2. LP® SolidStart® LSL and LVL having a minimum thickness of 1 inch (25.4 mm) is permitted to be used as an alternate to $^{23}/_{32}$ inch (18.3 mm) wood structural panel fire blocking, provided the joints are backed accordingly.

4.6 Roof and Ceiling Framing:

LP® SolidStart® LSL may be used as ceiling joists and rafter framing in conventional light-frame construction in accordance with Section 2308.7 of the 2018 and 2015 IBC (2308.10 of the 2012 and 2009 IBC) and Section R802 of the IRC. Spans for LP® SolidStart® LSL rafters are given in Table 6.

5.0 CONDITIONS OF USE

The LP® SolidStart® LSL and LVL described in this report comply with, or are suitable alternatives to what is specified in, those codes specifically listed in Section 1.0 of this report, subject to the following conditions:

5.1 Fabrication, design, installation, and connection restrictions must comply with this report and the manufacturer's published installation instructions. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.

5.2 Use of LP® SolidStart® LSL and LVL must be limited to dry, well-ventilated interior applications in which the in-service average moisture content of lumber is less than 16 percent. Use of LP® SolidGuard® LSL must be limited to interior locations, continuously protected from the weather, and cannot be in contact with the ground, but may be subject to dampness, as defined by the American Wood Protection Association (AWPA) Use Category UC2.

5.3 Calculations and drawings demonstrating compliance with this report must be submitted to the code official. The calculations and drawings must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

5.4 LP® SolidStart® LSL is produced by the Louisiana-Pacific Corporation at its Houlton, Maine, facility under a quality control program with inspections by ICC-ES and APA—The Engineered Wood Association (AA-649).

5.5 LP® SolidStart® LVL is produced by the Louisiana-Pacific Corporation at its Golden, British Columbia, Canada, and Wilmington, North Carolina facilities; and by the Murphy Engineered Wood Division, in Sutherlin, Oregon; under a quality-control program with inspections by ICC-ES and APA—The Engineered Wood Association (AA-649).

6.0 EVIDENCE SUBMITTED

6.1 Data in accordance with the ICC-ES Acceptance Criteria for Structural Wood-based Products (AC47), dated June 2017 (editorially revised March 2018).

6.2 Data in accordance with the ICC-ES Acceptance Criteria for Wood-based Studs (AC202), dated June 2009 (editorially revised March 2018).

6.3 Data in accordance with the ICC-ES Acceptance Criteria for Rim Board Products (AC124), dated June 2019.

6.4 Data in accordance with the ICC-ES Acceptance Criteria for Zinc Borate (ZB) Preservative Treatment of Structural Composite Wood Products by Non-pressure Processes (AC203), dated August 2017 (editorially revised November 2018).

7.0 IDENTIFICATION

7.1 LP® SolidStart® LSL, LP® SolidGuard® LSL, and LP® SolidStart® LVL are identified with stamps noting the Louisiana-Pacific Corporation name or logo, plant number, product designation, grade, production date and shift, evaluation report number (ESR-2403), and the third-party inspection agency (APA—The Engineered Wood Association). LP® SolidGuard® LSL is also identified with the designations "ZB" and "AWPA UC2". LP® SolidStart® LSL and LP® SolidGuard® LSL

are also labeled as Boise Cascade Versa-Strand® LSL and Boise Cascade Versa-Strand® ZB LSL.

7.2 The report holder's contact information is as follows:

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7.3 The Additional Listees' contact information is the following:

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MURPHY ENGINEERED WOOD DIVISION
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TABLE 1—REFERENCE DESIGN VALUES FOR LP® SolidStart® LSL AND LVL [1,2,3,4]

GRADE	BEAM ORIENTATION					PLANK ORIENTATION					AXIAL	
	Modulus of Elasticity		Bending [8]	Shear	Compression Perp-to-Grain	Modulus of Elasticity		Bending	Shear	Compression Perp-to-Grain	Compression	Tension
	E [5] (x10^6 psi)	E_{min} [7] (x10^6 psi)	F_b (psi)	F_v (psi)	$F_{c\perp}$ [15] (psi)	E [5] (x10^6 psi)	E_{min} [7] (x10^6 psi)	F_b (psi)	F_v (psi)	$F_{c\perp}$ [15] (psi)	F_c (psi)	F_t (psi)
LP SolidStart LSL												
1730F_b-1.35E	1.35	0.68	1730 [9]	445	750	1.35	0.68	1910	155	685	1650	1300 [13]
2360F_b-1.55E	1.55	0.78	2360 [9]	495	875	1.55	0.78	2620	155	775	2175	1750 [13]
2500F_b-1.75E	1.75	0.88	2500 [9]	545	950	1.75	0.88	2800	155	890	2450	2100 [13]
LP SolidStart LVL												
2250F_b-1.5E	1.50	0.75	2250 [10]	285	750	1.40	0.70	2200 [12]	140	550	2350	1350 [14]
2400F_b-1.7E	1.70	0.85	2400 [10]	285	750	1.70	0.85	2300 [12]	140	550	2350	1350 [14]
2650F_b-1.9E	1.90 [6]	0.98	2650 [10]	285	750	1.80 [6]	0.93	2600 [12]	140	550	2350	1600 [14]
2900F_b-2.0E	2.00	1.00	2900 [10]	285	750	2.00	1.00	2950 [12]	140	550	3200	1800 [14]
2950F_b-2.0E	2.00 [6]	1.04	2950 [10]	290	750	2.00 [6]	1.04	2950 [12]	140	550	3200	1800 [14]
3100F_b-2.0E	2.00 [6]	1.04	3100 [10]	290	750	2.00 [6]	1.04	3100 [12]	140	550	3200	1800 [14]
3100F_b-2.1E	2.10	1.05	3100 [10]	290	750	2.00	1.00	3100 [12]	140	550	3200	1800 [14]
3100F_b-2.2E	2.20	1.11	3100 [10]	290	750	2.20	1.11	2950 [12]	140	550	3200	1800 [14]
LP SolidStart LVL Rim Board (with cross-ply)												
1400F_b-1.1E	1.10	0.55	1400 [11]	250	680	1.00	0.50	1400	95	550	1700	1200 [14]
1650F_b-1.3E	1.30	0.65	1650 [11]	250	680	1.10	0.55	1650	140	550	1700	1200 [14]
1750F_b-1.3E	1.30	0.65	1750 [11]	250	680	1.30	0.65	1750	140	550	1700	1200 [14]

For **SI**: 1 psi = 6.89 kPa, 1 inch = 25.4 mm.

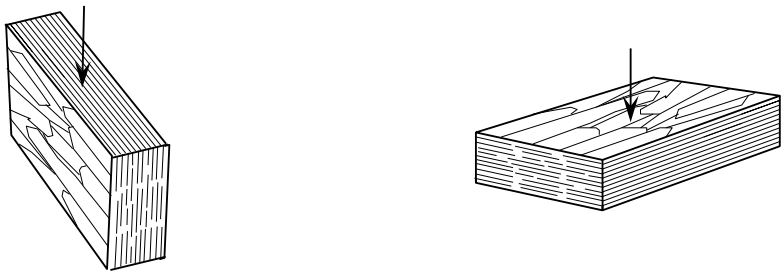
[1]Reference design values in the above table apply only to dry, well-ventilated interior applications where the equivalent moisture content in lumber is less than 16 percent.
[2]Reference design values in the above table are for normal load duration. Tabulated values must be adjusted by the applicable adjustment factors in accordance with the NDS. Modulus of elasticity and compression perpendicular-to-grain must not be adjusted for duration of load.
[3]Reference design values given for Beam Orientation refer to loads applied parallel to the wide face of the strands or veneers (applied to the edge of the member). Plank Orientation refers to loads applied perpendicular to the wide face of the strands or veneers (applied to the face of the member). See diagrams on following page.
[4]Reference design values for bending, axial compression and axial tension for studs with notches or holes in engineered wall framing must be multiplied by the strength reduction factors in Table 5.
[5]The reference E values given for LP® LSL and all grades LP® LVL except the 2650F_b-1.9E, 2950Fb-2.0E and 3100F_b-2.0E are the shear-free modulus of elasticity. When calculating deflection, both bending and shear deformations must be included. Equations for various span and load conditions are available in engineering references. For example, the deflection equation for a simply-supported beam under uniform load is:

$$\Delta = \frac{270wL^4}{Ebd^3} + \frac{28.8wL^2}{Ebd}$$

where:

Δ = Deflection in inches (in).
w = Uniform load in pounds per lineal foot (plf).
L = Design span in feet (ft).
b = Beam width in inches (in).
d = Beam depth in inches (in).
E = Shear Free Modulus of Elasticity in pounds per square inch (psi).

[6]The reference E values given for the 2650F_b-1.9E, 2950F_b-2.0E and 3100F_b-2.0E grades of LP® LVL are the apparent modulus of elasticity, which include the effects of shear deformation. When calculating deflection, standard engineering formulae for pure bending deflection are sufficient, and the second term of the above equation may be ignored.
[7]E_{min} is the reference modulus of elasticity for beam stability and column stability calculations.
[8]Reference bending design values in the beam orientation, F_b, may be increased by 4% when the member qualifies as a repetitive member, in accordance with Section 8.3.7 of the NDS.
[9]Reference bending design values in the beam orientation, F_b, for LP® LSL are assigned for a standard depth of 12 inches. For other depths greater than $3^1/_2$ inches, multiply F_b by a volume factor of (12/d) $^{0.120}$, where *d* is the depth of the member in inches. For depths $3^1/_2$ inches or less, multiply F_b by 1.159.
[10]Reference bending design values in the beam orientation, F_b, for LP® LVL are assigned for a standard depth of 12 inches. For depths greater than 12 inches, multiply F_b by a volume factor of (12/d) $^{0.143}$, where *d* is the depth of the member in inches. For depths less than 12 inches but greater than $3^1/_2$ inches, multiply F_b by (12/d) $^{0.111}$. For depths $3^1/_2$ inches or less, multiply F_b by 1.147.
[11]Reference bending design values in the beam orientation, F_b, for LP® LVL Rim Board (cross-ply) are assigned for a standard depth of 12 inches. For other depths, adjust F_b as follows, based on the LVL thickness:
- For thickness < $1^1/_4$ inches, multiply F_b by a volume factor of (12/d) $^{0.323}$, where *d* is the depth of the member in inches, except where *d* is less than $3^1/_2$ inches, multiply F_b by 1.488.
- For thickness ≥ $1^1/_4$ inches, multiply F_b by a volume factor of (12/d) $^{0.261}$, where *d* is the depth of the member in inches, except where *d* is less than $3^1/_2$ inches, multiply F_b by 1.379.
[12]For LP LVL "Billet Beam" up to 7 inches thick, the reference bending design values in the plank orientation, F_b, shall be multiplied by (1.75/d) 0.25 ≤ 1.0, where d is the flat depth (i.e., thickness of the "Billet Beam") of the member in inches.
[13]Reference tension design values, F_t, are assigned for a standard length of 3 feet. For lengths longer than 3 feet, multiply F_t by $(3/L)^{0.092}$, where *L* is the length in feet. For lengths less than 3 feet, use the reference tension design value given in the table above.
[14]Reference tension design values, F_t, are assigned for a standard length of 3 feet. For lengths longer than 3 feet, multiply F_t by $(3/L)^{0.111}$, where *L* is the length in feet. For lengths less than 3 feet, use the reference tension design value given in the table above.
[15]The NDS bearing area factor, C_b, is permitted to be applied to the reference compression perpendicular-to-grain design values, $F_{c\perp}$.



Beam Orientation Plank Orientation

FIGURE 1—BEAM AND PLANK ORIENTATION AS NOTED IN TABLE 1

TABLE 2—EQUIVALENT SPECIFIC GRAVITY FOR FASTENER DESIGN [1,2,3]

GRADE	EQUIVALENT SPECIFIC GRAVITY					
	Nails and Screws				Bolts and Lag Screws [4, 5]	
	Withdrawal		Dowel Bearing		Dowel Bearing (Installed in Face)	
	Installed in Edge	Installed in Face	Installed in Edge	Installed in Face	Load Applied Parallel to Grain	Load Applied Perpendicular to Grain
LP SolidStart LSL						
1730F_b-1.35E and Above	0.46	0.50	0.50	0.55	0.50	0.58
LP SolidStart LVL						
2250F_b-1.5E and Above	0.46 [6]	0.50	0.50	0.50	0.46 [7]	0.50
LP SolidStart LVL Rim Board (cross-ply)						
1400F_b-1.1E	0.42	0.48	0.49	0.50	0.41	0.48
1650F_b-1.3E	0.46	0.50	0.50	0.50	0.46	0.50
1750F_b-1.3E	0.46	0.50	0.50	0.50	0.46	0.50

[1]Fastener types and orientation not specifically described above are outside the scope of this report.
[2]Fastener design values calculated using the tabulated equivalent specific gravities given above must be adjusted by the applicable adjustment factors specified in the NDS for connections.
[3]Minimum nail spacing and end distance must be as specified in Table 3. Minimum spacing, end and edge distances for bolts and lag screws must be as specified in the NDS.
[4]Equivalent specific gravity values apply only to bolts and lag screws installed into the face of the LP® SolidStart® LSL and LVL, such that the bolt axis is perpendicular to the wide faces of the strands or veneers.
[5]The allowable lateral loads for lag screw connections between LP® SolidStart® LSL and LVL rim board and deck ledgers complying with the exception to Section 4.2 are given in Table 4.
[6]The equivalent specific gravity is permitted to be increased to 0.49 for LP® SolidStart® LVL stamped with the plant number 1089.
[7]The equivalent specific gravity is permitted to be increased to 0.50 for LP® SolidStart® LVL stamped with the plant number 1089.

TABLE 3—NAIL SPACING REQUIREMENTS FOR LP® SolidStart® LSL AND LVL[1,2]

MEMBER THICKNESS (in.)	FASTENER ORIENTATION [5]	COMMON NAIL SIZE [6, 7]	MINIMUM END DISTANCE (in.)	MINIMUM NAIL SPACING (in.)	
				Single Row	Multiple Rows [3, 4]
LP® SolidStart® LSL					
1″ ≤ thickness < 1 1/4″	Edge [8]	8d & smaller	2	4	NA
		10d & 12d	2	4	
		16d	NA [10]	NA [10]	
	Face [9]	8d & smaller	7/8	1	1
		10d & 12d	7/8	1	1
		16d	7/8	1 1/2	1 1/2
1 1/4″ ≤ thickness < 1 1/2″	Edge [8]	8d & smaller	2	4	NA
		10d & 12d	2	4	
		16d	2 1/2 [11]	5 [12]	
	Face [9]	8d & smaller	7/8	1	1
		10d & 12d	7/8	1	1
		16d	7/8	1 1/2	1 1/2
1 1/2″ ≤ thickness < 1 3/4″	Edge [8]	8d & smaller	2	3	3
		10d & 12d	2	3	4
		16d	2 1/2 [11]	4	6
	Face [9]	8d & smaller	7/8	1	1
		10d & 12d	7/8	1	1
		16d	7/8	1 1/2	1 1/2
≥ 1 3/4″	Edge [8]	8d & smaller	2	3	3
		10d & 12d	2	3	4
		16d	2 1/2 [11]	3	6
	Face [9]	8d & smaller	7/8	1	1
		10d & 12d	7/8	1	1
		16d	7/8	1 1/2	1 1/2
LP® SolidStart® LVL					
< 1 1/2″	Edge [8]	8d & smaller	2 1/2	4	N/A
		10d & 12d	2 1/2	4	
		16d	3 1/2	5	
	Face [9]	8d & smaller	1 1/2	3	3
		10d & 12d	1 1/2	3	3
		16d	1 1/2	5	5
≥ 1 1/2″	Edge [8]	8d & smaller	2 1/2	3	4 [13]
		10d & 12d	2 1/2	4	5 [13]
		16d	3 1/2	5	6 [13, 14]
	Face [9]	8d & smaller	1 1/2	3	3
		10d & 12d	1 1/2	3	3
		16d	1 1/2	5	5

For **SI**: 1 inch = 25.4 mm.

[1]Spacing requirements and maximum nail size for panel edge nailing of wall sheathing at adjoining panels must be in accordance with Section 4.3.2 and Figure 3.
[2]Edge distance must be sufficient to prevent splitting.
[3]For multiple rows of nails, the rows must be offset 1/2 inch or more from each other, and staggered.
[4]For multiple rows of nails, the rows must be equally spaced about the centerline of the edge or face (whichever applies).
[5]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.
[6]16d sinkers (3 1/4 in. x 0.148 in. diameter) are considered equivalent to 12d common nails for the purpose of this table.
[7]Nails listed are common wire nails. For box nails, the spacing and end distance requirements of the next shorter common nail may be used (e.g., a 16d box nail may be spaced the same as a 10d and 12d common nail). Larger nail sizes and shank types not specifically described above are outside the scope of this report.
[8]Nail penetration for edge nailing must not exceed 2 inches for 16d common nails (3 1/2 in. by 0.162 in. diameter) and 2 1/2 inches for all nails with a smaller shank diameter.
[9]Minimum nail spacing for the face orientation is applicable to nails that are installed in rows that are parallel to the direction of the grain (length) of the LSL or LVL. For nails driven into the face in rows that are perpendicular to the direction of the grain (width/depth) of the LSL or LVL, the minimum spacing must be sufficient to prevent splitting of the wood.
[10]For LSL thicknesses of 1 1/8-inch or greater, 16d common nails are permitted to be driven into the edge, with a minimum end distance of 2 1/2 inches and a minimum spacing of 5 inches. For LSL thicknesses less than 1 1/8-inch, 16d common nails are not permitted to be driven into the edge.
[11]Minimum end distance may be reduced to 2 inches when the nail penetration into the edge of the LSL does not exceed 1 3/8 inches.
[12]Minimum nail spacing may be reduced to 4 inches when the nail penetration into the edge of the LSL does not exceed 1 3/8 inches.
[13]Minimum nail spacing is tabulated for LVL stamped with plant number 1089. The minimum nail spacing is permitted to be reduced 1 inch for LVL stamped with the plant numbers 1066 and 1071.
[14]Minimum nail spacing is permitted to be reduced 1 inch for LVL stamped with plant number 1089, for thickness of 1 3/4-inch or greater.

TABLE 4—ALLOWABLE DESIGN LOADS FOR LP® SolidStart® LSL AND LVL RIM BOARD [1,2]

GRADE	THICKNESS, t (in.)	LATERAL LOAD CAPACITY [3, 4, 5] (lbf/ft)	VERTICAL LOAD CAPACITY			$^1/_2$″ DIA. LAG SCREW CAPACITY FOR DECK LEDGER [7] (lb)
			Uniform Load [6] (lbf/ft)		Concentrated (lbf)	
			Depth ≤ 16″	16″< Depth ≤ 24″	Depth ≤ 24″	
LP® SolidStart® LSL RIM BOARD						
1730F_b-1.35E and higher	$1^1/_4 \le t < 1^1/_2$	250	6000	3800	3800	675
	$t \ge 1^1/_2$	280	7000	4500	4500	700 [8]
LP® SolidStart® LVL RIM BOARD (cross-ply)						
1400F_b-1.1E	$t \ge 1^1/_4$	250	8000	5070	4210	450
1650F_b-1.3E	1 and $1^1/_8$	190	7210	4990	3870	300 (t = 1″) 400 (t = $1^1/_8$″)
1750F_b-1.3E	$t \ge 1^1/_4$	250	9350	5070	4210	550
LP® SolidStart® LVL (no cross-ply)						
2250F_b-1.5E and higher	$1^1/_2 \le t < 1^3/_4$	250	4000	2500	2700	550
	$t \ge 1\ ^3/_4$	250	4500	3450	3200	550

For **SI**: 1 inch = 25.4 mm, 1 LB. = 4.45 N, 1 lb/ft = 14.6 N/m.

[1]Allowable design loads in the above table cannot be increased for load duration.
[2]See Table 3 for minimum nail spacing requirements.
[3]The lateral load capacity is for seismic design and is permitted to be multiplied by 1.4 for wind load applications. For shear loads of normal or permanent load duration as defined by the NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.
[4]Toe-nailed connections are not limited by the 150 lb/ft lateral load capacity noted for Seismic Design Categories D, E, and F in Section 4.1.7 of the ANSI/AWC *Seismic Design Provisions for Wind & Seismic* (SDPWS).
[5]The nailing schedule for sheathing-to-rim and rim-to-sill plate (toe-nailed) is based on minimum 8d box nails ($2^1/_2$ in x 0.113 in. diameter) at 6 inches on center. Commercial framing connectors fastened to the face of the rim board and wall plates may be used to achieve lateral load capacities exceeding values in this table. Calculations must be based on equivalent specific gravity listed in Table 2, and must not exceed the nail spacing requirements of Table 3.
[6]The allowable 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 or the attached floor sheathing.
[7]Lag screw connections between LP® SolidStart® LSL and LVL rim board and deck ledgers have allowable lateral loads as specified in the table above, provided the conditions under the exception to Section 4.2 are met.
[8]The lag screw capacity for deck ledger attachment is permitted to be increased to 725 lbf for LP® SolidStart® LSL thickness of $1^3/_4$-inch or greater.

TABLE 5—STRENGTH REDUCTION FACTORS FOR NOTCHES AND HOLES IN LP® SolidStart® LSL AND LVL STUDS [1, 2, 3]

MATERIAL	NOTCHES			HOLES		
	Bending	Compression	Tension	Bending	Compression	Tension
LP® LSL	0.95	0.90	0.70 [4]	1.00	1.00	1.00
LP® LVL	0.80	0.90	0.60	0.95	0.95	0.95

[1]Design of LP® LSL and LP® LVL studs with notches and holes used in engineered wall framing must be based on a net-section analysis in accordance with the NDS. See Section 4.3.2 of this report for limitations on the allowed size and placement of notches and holes.
[2]The reference design values for bending, axial compression and axial tension from Table 1 must be multiplied by the strength reduction factors given above for studs with notches or holes in engineered wall framing.
[3]See Section 4.3.1 for notching and boring of holes in LP® LSL and LP® LVL studs used in prescriptive wall framing.
[4]For 1.35E and 1.55E LSL, an adjustment value of 0.75 may be used in lieu of 0.70.

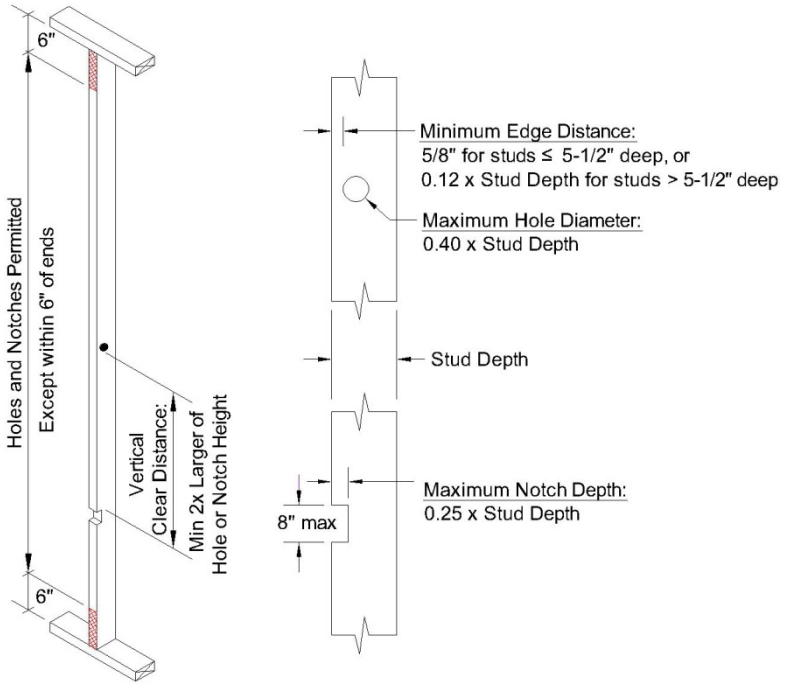


FIGURE 2—NOTCHING AND BORING REQUIREMENTS FOR LP® SolidStart® LSL AND LVL STUDS IN ENGINEERED APPLICATIONS

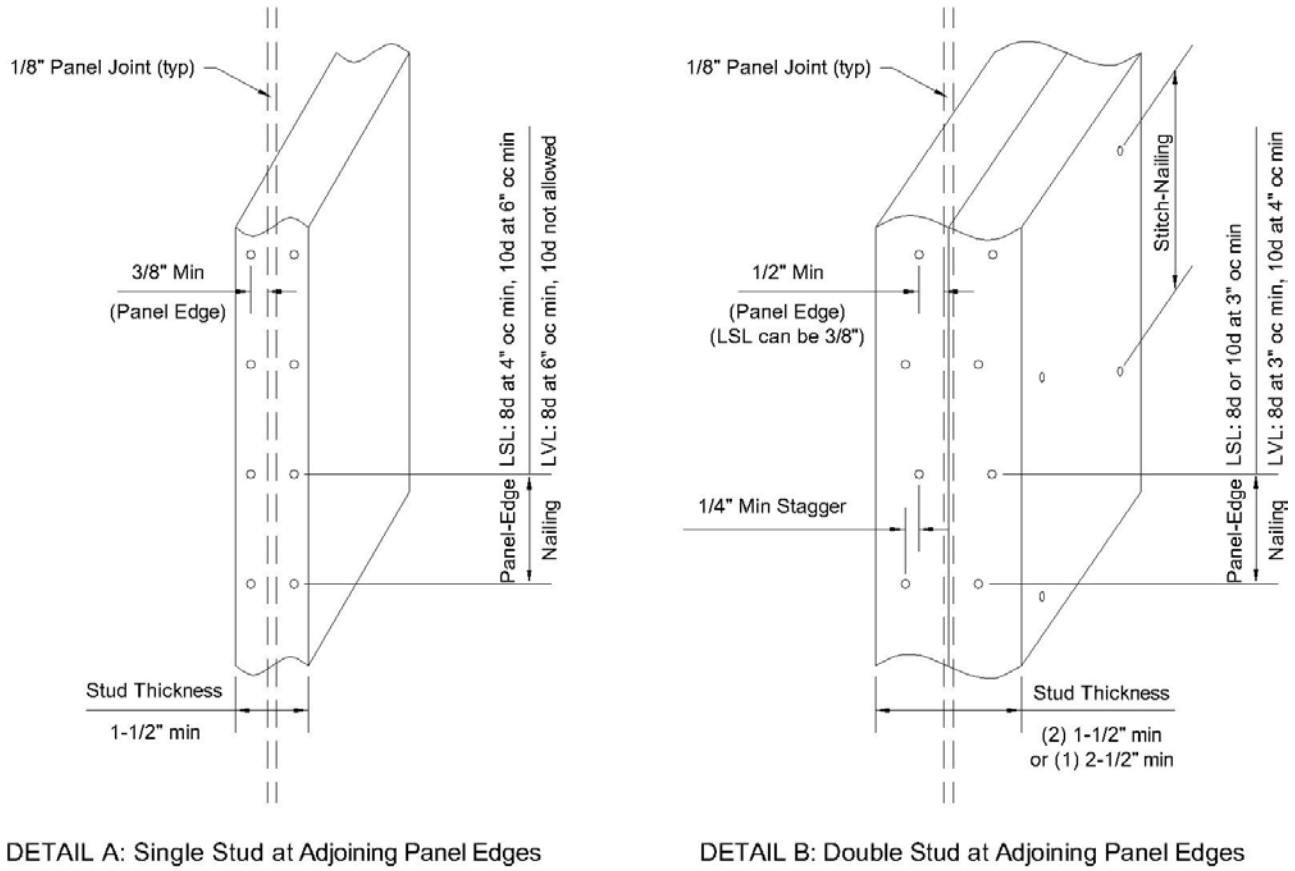


FIGURE 3—PANEL EDGE NAILING REQUIREMENTS FOR LP® SolidStart® LSL AND LVL STUDS

TABLE 6—RAFTER SPANS FOR LP® SolidStart® LSL[1,2]

ROOF LIVE LOAD = 20 psf (C_D = 1.25)															
CEILING NOT ATTACHED TO RAFTERS, L/Δ = 180															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	10-2	16-0	21-1	26-0	26-0	26-0	26-0	9-3	14-6	19-2	24-5	25-1	26-0	26-0
	2360F_b-1.55E	10-8	16-9	22-1	26-0	26-0	26-0	26-0	9-8	15-2	20-0	25-7	26-0	26-0	26-0
	2500F_b-1.75E	11-1	17-5	23-0	26-0	26-0	26-0	26-0	10-1	15-10	20-11	26-0	26-0	26-0	26-0
16	1730F_b-1.35E	9-3	14-6	19-2	24-5	25-1	26-0	26-0	8-4	13-2	17-4	22-2	22-9	26-0	26-0
	2360F_b-1.55E	9-8	15-2	20-0	25-7	26-0	26-0	26-0	8-9	13-9	18-2	23-3	23-10	26-0	26-0
	2500F_b-1.75E	10-1	15-10	20-11	26-0	26-0	26-0	26-0	9-2	14-4	18-11	24-2	24-10	26-0	26-0
19.2	1730F_b-1.35E	8-8	13-8	18-0	22-11	23-7	26-0	26-0	7-10	12-4	16-4	20-10	21-5	25-4	26-0
	2360F_b-1.55E	9-1	14-3	18-10	24-1	24-8	26-0	26-0	8-3	12-11	17-1	21-10	22-5	26-0	26-0
	2500F_b-1.75E	9-6	14-11	19-8	25-1	25-9	26-0	26-0	8-7	13-6	17-10	22-9	23-4	26-0	26-0
24	1730F_b-1.35E	8-0	12-8	16-8	21-3	21-10	25-11	26-0	7-3	11-6	15-1	19-4	19-10	23-6	24-10
	2360F_b-1.55E	8-5	13-3	17-6	22-4	22-11	26-0	26-0	7-8	12-0	15-10	20-3	20-9	24-7	26-0
	2500F_b-1.75E	8-9	13-10	18-2	23-3	23-10	26-0	26-0	7-11	12-6	16-6	21-1	21-8	25-8	26-0
CEILING ATTACHED TO RAFTERS, L/Δ = 240															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	8-10	13-11	18-5	23-6	24-1	26-0	26-0	8-0	12-8	16-8	21-3	21-10	25-11	26-0
	2360F_b-1.55E	9-3	14-7	19-3	24-7	25-3	26-0	26-0	8-5	13-3	17-6	22-4	22-11	26-0	26-0
	2500F_b-1.75E	9-8	15-2	20-1	25-7	26-0	26-0	26-0	8-9	13-10	18-2	23-3	23-10	26-0	26-0
16	1730F_b-1.35E	8-0	12-8	16-8	21-3	21-10	25-11	26-0	7-3	11-6	15-1	19-4	19-10	23-6	24-10
	2360F_b-1.55E	8-5	13-3	17-6	22-4	22-11	26-0	26-0	7-8	12-0	15-10	20-3	20-9	24-7	26-0
	2500F_b-1.75E	8-9	13-10	18-2	23-3	23-10	26-0	26-0	7-11	12-6	16-6	21-1	21-8	25-8	26-0
19.2	1730F_b-1.35E	7-7	11-11	15-8	20-0	20-7	24-4	25-8	6-10	10-9	14-3	18-2	18-8	22-1	23-4
	2360F_b-1.55E	7-11	12-5	16-5	21-0	21-6	25-6	26-0	7-2	11-4	14-11	19-0	19-6	23-2	24-5
	2500F_b-1.75E	8-3	13-0	17-1	21-10	22-5	26-0	26-0	7-6	11-9	15-6	19-10	20-4	24-1	25-6
24	1730F_b-1.35E	7-0	11-0	14-6	18-7	19-1	22-7	23-10	6-4	10-0	13-2	16-10	17-3	20-6	21-7
	2360F_b-1.55E	7-4	11-7	15-3	19-5	20-0	23-8	25-0	6-8	10-6	13-10	17-8	18-1	21-5	22-8
	2500F_b-1.75E	7-8	12-0	15-10	20-3	20-10	24-8	26-0	6-11	10-11	14-5	18-4	18-10	22-4	23-7

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kPa.

[1]The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.
H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

[2]Rafter sizes are given in nominal lumber dimensions except the 1 1/2 x 9 1/2 and 1 1/2 x 11 7/8 rafter sizes are standard LP® LSL dimensions.

TABLE 6—RAFTER SPANS FOR LP® SolidStart® LSL[1,2] (continued)

GROUND SNOW LOAD = 30 psf (C_D = 1.15)															
CEILING NOT ATTACHED TO RAFTERS, L/Δ = 180															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	8-10	13-11	18-5	23-6	24-1	26-0	26-0	8-7	13-5	17-9	22-8	23-3	26-0	26-0
	2360F_b-1.55E	9-3	14-7	19-3	24-7	25-3	26-0	26-0	8-11	14-1	18-7	23-9	24-4	26-0	26-0
	2500F_b-1.75E	9-8	15-2	20-1	25-7	26-0	26-0	26-0	9-4	14-8	19-4	24-9	25-5	26-0	26-0
16	1730F_b-1.35E	8-0	12-8	16-8	21-3	21-10	25-11	26-0	7-9	12-2	16-1	20-7	21-1	25-0	26-0
	2360F_b-1.55E	8-5	13-3	17-6	22-4	22-11	26-0	26-0	8-1	12-9	16-10	21-6	22-1	26-0	26-0
	2500F_b-1.75E	8-9	13-10	18-2	23-3	23-10	26-0	26-0	8-6	13-4	17-7	22-5	23-0	26-0	26-0
19.2	1730F_b-1.35E	7-7	11-11	15-8	20-0	20-7	24-4	25-8	7-3	11-6	15-1	19-4	19-10	23-5	24-8
	2360F_b-1.55E	7-11	12-5	16-5	21-0	21-6	25-6	26-0	7-8	12-0	15-10	20-3	20-9	24-7	26-0
	2500F_b-1.75E	8-3	13-0	17-1	21-10	22-5	26-0	26-0	7-11	12-6	16-6	21-1	21-8	25-8	26-0
24	1730F_b-1.35E	7-0	11-0	14-6	18-7	19-1	22-7	23-10	6-9	10-7	13-10	17-5	17-10	20-11	22-0
	2360F_b-1.55E	7-4	11-7	15-3	19-5	20-0	23-8	25-0	7-1	11-2	14-8	18-9	19-3	22-10	24-1
	2500F_b-1.75E	7-8	12-0	15-10	20-3	20-10	24-8	26-0	7-5	11-7	15-4	19-7	20-1	23-9	25-1
CEILING ATTACHED TO RAFTERS, L/Δ = 240															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	8-0	12-8	16-8	21-3	21-10	25-11	26-0	7-5	11-9	15-6	19-9	20-3	24-0	25-4
	2360F_b-1.55E	8-5	13-3	17-6	22-4	22-11	26-0	26-0	7-10	12-3	16-2	20-8	21-3	25-2	26-0
	2500F_b-1.75E	8-9	13-10	18-2	23-3	23-10	26-0	26-0	8-2	12-10	16-11	21-7	22-2	26-0	26-0
16	1730F_b-1.35E	7-3	11-6	15-1	19-4	19-10	23-6	24-10	6-9	10-7	14-0	17-11	18-5	21-9	23-0
	2360F_b-1.55E	7-8	12-0	15-10	20-3	20-9	24-7	26-0	7-1	11-2	14-8	18-9	19-3	22-10	24-1
	2500F_b-1.75E	7-11	12-6	16-6	21-1	21-8	25-8	26-0	7-5	11-7	15-4	19-7	20-1	23-9	25-1
19.2	1730F_b-1.35E	6-10	10-9	14-3	18-2	18-8	22-1	23-4	6-4	10-0	13-2	16-10	17-3	20-6	21-7
	2360F_b-1.55E	7-2	11-4	14-11	19-0	19-6	23-2	24-5	6-8	10-6	13-10	17-8	18-1	21-5	22-8
	2500F_b-1.75E	7-6	11-9	15-6	19-10	20-4	24-1	25-6	6-11	10-11	14-5	18-4	18-10	22-4	23-7
24	1730F_b-1.35E	6-4	10-0	13-2	16-10	17-3	20-6	21-7	5-11	9-3	12-2	15-7	16-0	19-0	20-0
	2360F_b-1.55E	6-8	10-6	13-10	17-8	18-1	21-5	22-8	6-2	9-8	12-10	16-4	16-9	19-11	21-0
	2500F_b-1.75E	6-11	10-11	14-5	18-4	18-10	22-4	23-7	6-5	10-1	13-4	17-0	17-6	20-9	21-11

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kPa.

[1]The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.
H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

[2]Rafter sizes are given in nominal lumber dimensions except the 1 1/2 x 9 1/2 and 1 1/2 x 11 7/8 rafter sizes are standard LP® LSL dimensions.

TABLE 6—RAFTER SPANS FOR LP® SolidStart® LSL[1,2] (continued)

GROUND SNOW LOAD = 50 psf (C_D = 1.15)															
CEILING NOT ATTACHED TO RAFTERS, L/Δ = 180															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	7-5	11-9	15-6	19-9	20-3	24-0	25-4	7-5	11-9	15-6	19-9	20-3	24-0	25-4
	2360F_b-1.55E	7-10	12-3	16-2	20-8	21-3	25-2	26-0	7-10	12-3	16-2	20-8	21-3	25-2	26-0
	2500F_b-1.75E	8-2	12-10	16-11	21-7	22-2	26-0	26-0	8-2	12-10	16-11	21-7	22-2	26-0	26-0
16	1730F_b-1.35E	6-9	10-7	14-0	17-11	18-5	21-9	23-0	6-9	10-7	14-0	17-11	18-5	21-8	22-10
	2360F_b-1.55E	7-1	11-2	14-8	18-9	19-3	22-10	24-1	7-1	11-2	14-8	18-9	19-3	22-10	24-1
	2500F_b-1.75E	7-5	11-7	15-4	19-7	20-1	23-9	25-1	7-5	11-7	15-4	19-7	20-1	23-9	25-1
19.2	1730F_b-1.35E	6-4	10-0	13-2	16-10	17-3	20-6	21-7	6-4	10-0	13-1	16-5	16-10	19-9	20-10
	2360F_b-1.55E	6-8	10-6	13-10	17-8	18-1	21-5	22-8	6-8	10-6	13-10	17-8	18-1	21-5	22-8
	2500F_b-1.75E	6-11	10-11	14-5	18-4	18-10	22-4	23-7	6-11	10-11	14-5	18-4	18-10	22-4	23-7
24	1730F_b-1.35E	5-11	9-3	12-2	15-7	16-0	19-0	20-0	5-10	9-0	11-8	14-8	15-1	17-8	18-7
	2360F_b-1.55E	6-2	9-8	12-10	16-4	16-9	19-11	21-0	6-2	9-8	12-10	16-4	16-9	19-11	21-0
	2500F_b-1.75E	6-5	10-1	13-4	17-0	17-6	20-9	21-11	6-5	10-1	13-4	17-0	17-6	20-9	21-11
CEILING ATTACHED TO RAFTERS, L/Δ = 240															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	6-9	10-7	14-0	17-11	18-5	21-9	23-0	6-8	10-5	13-9	17-7	18-1	21-5	22-7
	2360F_b-1.55E	7-1	11-2	14-8	18-9	19-3	22-10	24-1	7-0	10-11	14-5	18-5	18-11	22-5	23-8
	2500F_b-1.75E	7-5	11-7	15-4	19-7	20-1	23-9	25-1	7-3	11-5	15-1	19-3	19-9	23-5	24-8
16	1730F_b-1.35E	6-1	9-8	12-8	16-3	16-8	19-9	20-10	6-0	9-6	12-6	15-11	16-5	19-5	20-6
	2360F_b-1.55E	6-5	10-1	13-4	17-0	17-6	20-8	21-10	6-4	9-11	13-1	16-9	17-2	20-4	21-6
	2500F_b-1.75E	6-8	10-6	13-11	17-9	18-2	21-7	22-9	6-7	10-4	13-8	17-5	17-11	21-3	22-5
19.2	1730F_b-1.35E	5-9	9-1	11-11	15-3	15-8	18-7	19-7	5-8	8-11	11-9	15-0	15-5	18-3	19-3
	2360F_b-1.55E	6-0	9-6	12-6	16-0	16-5	19-5	20-6	5-11	9-4	12-4	15-9	16-2	19-2	20-2
	2500F_b-1.75E	6-3	9-11	13-1	16-8	17-1	20-3	21-5	6-2	9-9	12-10	16-5	16-10	19-11	21-1
24	1730F_b-1.35E	5-4	8-5	11-1	14-1	14-6	17-2	18-2	5-3	8-3	10-10	13-11	14-3	16-11	17-10
	2360F_b-1.55E	5-7	8-9	11-7	14-10	15-2	18-0	19-0	5-6	8-8	11-5	14-7	14-11	17-9	18-8
	2500F_b-1.75E	5-10	9-2	12-1	15-5	15-10	18-9	19-10	5-9	9-0	11-11	15-2	15-7	18-6	19-6

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kPa.

[1]The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.
H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

[2]Rafter sizes are given in nominal lumber dimensions except the 1 1/2 x 9 1/2 and 1 1/2 x 11 7/8 rafter sizes are standard LP® LSL dimensions.

TABLE 6—RAFTER SPANS FOR LP® SolidStart® LSL[1,2] (continued)

GROUND SNOW LOAD = 70 psf (C_D = 1.15)															
CEILING NOT ATTACHED TO RAFTERS, L/Δ = 180															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	6-8	10-5	13-9	17-7	18-1	21-5	22-7	6-8	10-5	13-9	17-7	18-1	21-5	22-7
	2360F_b-1.55E	7-0	10-11	14-5	18-5	18-11	22-5	23-8	7-0	10-11	14-5	18-5	18-11	22-5	23-8
	2500F_b-1.75E	7-3	11-5	15-1	19-3	19-9	23-5	24-8	7-3	11-5	15-1	19-3	19-9	23-5	24-8
16	1730F_b-1.35E	6-0	9-6	12-6	15-11	16-5	19-5	20-6	6-0	9-6	12-6	15-11	16-3	19-1	20-1
	2360F_b-1.55E	6-4	9-11	13-1	16-9	17-2	20-4	21-6	6-4	9-11	13-1	16-9	17-2	20-4	21-6
	2500F_b-1.75E	6-7	10-4	13-8	17-5	17-11	21-3	22-5	6-7	10-4	13-8	17-5	17-11	21-3	22-5
19.2	1730F_b-1.35E	5-8	8-11	11-9	15-0	15-5	18-3	19-3	5-8	8-11	11-6	14-6	14-10	17-5	18-4
	2360F_b-1.55E	5-11	9-4	12-4	15-9	16-2	19-2	20-2	5-11	9-4	12-4	15-9	16-2	19-2	20-2
	2500F_b-1.75E	6-2	9-9	12-10	16-5	16-10	19-11	21-1	6-2	9-9	12-10	16-5	16-10	19-11	21-1
24	1730F_b-1.35E	5-3	8-3	10-10	13-9	14-1	16-6	17-5	5-2	7-11	10-4	13-0	13-4	15-7	16-5
	2360F_b-1.55E	5-6	8-8	11-5	14-7	14-11	17-9	18-8	5-6	8-8	11-5	14-7	14-11	17-9	18-8
	2500F_b-1.75E	5-9	9-0	11-11	15-2	15-7	18-6	19-6	5-9	9-0	11-11	15-2	15-7	18-6	19-6
CEILING ATTACHED TO RAFTERS, L/Δ = 240															
RAFTER SPACING (inches)	**GRADE**	**DEAD LOAD = 10 psf**							**DEAD LOAD = 20 psf**						
		2 x 4	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**	**2 x 4**	**2 x 6**	**2 x 8**	**2 x 10**	**1 1/2 x 9 1/2**	**2 x 12**	**1 1/2 x 11 7/8**
		Maximum Rafter Spans[1] (feet – inches)													
12	1730F_b-1.35E	6-0	9-6	12-6	15-11	16-5	19-5	20-6	6-0	9-6	12-6	15-11	16-5	19-5	20-6
	2360F_b-1.55E	6-4	9-11	13-1	16-9	17-2	20-4	21-6	6-4	9-11	13-1	16-9	17-2	20-4	21-6
	2500F_b-1.75E	6-7	10-4	13-8	17-5	17-11	21-3	22-5	6-7	10-4	13-8	17-5	17-11	21-3	22-5
16	1730F_b-1.35E	5-5	8-7	11-4	14-5	14-10	17-7	18-7	5-5	8-7	11-4	14-5	14-10	17-7	18-7
	2360F_b-1.55E	5-9	9-0	11-10	15-2	15-7	18-5	19-6	5-9	9-0	11-10	15-2	15-7	18-5	19-6
	2500F_b-1.75E	6-0	9-5	12-5	15-10	16-3	19-3	20-4	6-0	9-5	12-5	15-10	16-3	19-3	20-4
19.2	1730F_b-1.35E	5-1	8-1	10-8	13-7	13-11	16-6	17-5	5-1	8-1	10-8	13-7	13-11	16-6	17-5
	2360F_b-1.55E	5-4	8-5	11-2	14-3	14-7	17-4	18-3	5-4	8-5	11-2	14-3	14-7	17-4	18-3
	2500F_b-1.75E	5-7	8-10	11-8	14-10	15-3	18-1	19-1	5-7	8-10	11-8	14-10	15-3	18-1	19-1
24	1730F_b-1.35E	4-9	7-6	9-10	12-7	12-11	15-4	16-2	4-9	7-6	9-10	12-7	12-11	15-4	16-2
	2360F_b-1.55E	5-0	7-10	10-4	13-2	13-6	16-1	16-11	5-0	7-10	10-4	13-2	13-6	16-1	16-11
	2500F_b-1.75E	5-2	8-2	10-9	13-9	14-1	16-9	17-8	5-2	8-2	10-9	13-9	14-1	16-9	17-8

For **SI**: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kPa.

[1]The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

H_C/H_R	Rafter Span Adjustment Factor
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

where:

H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.
H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

[2]Rafter sizes are given in nominal lumber dimensions except the 1 1/2 x 9 1/2 and 1 1/2 x 11 7/8 rafter sizes are standard LP® LSL dimensions.

DISCLAIMER

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DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 17 13—Laminated Veneer Lumber
Section: 06 17 25—Laminated Strand Lumber

REPORT HOLDER:

LOUISIANA–PACIFIC CORPORATION

EVALUATION SUBJECT:

LP® SOLIDSTART® LAMINATED STRAND LUMBER (LSL), LP® SOLIDGUARD® LAMINATED STRAND LUMBER (LSL) AND LP® SOLIDSTART® LAMINATED VENEER LUMBER (LVL)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that LP® SolidStart® Laminated Strand Lumber (LSL) and Laminated Veneer Lumber (LVL), and LP® SolidGuard® Laminated Strand Lumber (LSL), described in ICC-ES evaluation report ESR-2403, have also been evaluated for compliance with the codes noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

Applicable code editions:

- 2020 *City of Los Angeles Building Code* (LABC)
- 2020 *City of Los Angeles Residential Code* (LARC)

2.0 CONCLUSIONS

The LP® SolidStart® Laminated Strand Lumber (LSL) and Laminated Veneer Lumber (LVL), and LP® SolidGuard® Laminated Strand Lumber (LSL) described in Sections 2.0 through 7.0 of the evaluation report ESR-2403, comply with the LABC Chapter 23, and the LARC, and are subjected to the conditions of use described in this supplement.

3.0 CONDITIONS OF USE

The LP® SolidStart® Laminated Strand Lumber (LSL) and Laminated Veneer Lumber (LVL), LP® SolidGuard® Laminated Strand Lumber (LSL) described in this evaluation report supplement must comply with all of the following conditions:

- All applicable sections in the evaluation report ESR-2403.
- The design, installation, conditions of use and identification are in accordance with the 2018 *International Building Code®* (IBC) provisions noted in the evaluation report ESR-2403.
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.

This supplement expires concurrently with the evaluation report, reissued February 2019 and revised August 2020.

DIVISION: 06 00 00—WOOD, PLASTICS, AND COMPOSITES
Section: 06 17 13—Laminated Veneer Lumber
Section: 06 17 25—Laminated Strand Lumber

REPORT HOLDER:

LOUISIANA-PACIFIC CORPORATION

EVALUATION SUBJECT:

LP® SOLIDSTART® LAMINATED STRAND LUMBER (LSL), LP® SOLIDGUARD® LAMINATED STRAND LUMBER (LSL) AND LP® SOLIDSTART® LAMINATED VENEER LUMBER (LVL)

1.0 REPORT PURPOSE AND SCOPE

Purpose:

The purpose of this evaluation report supplement is to indicate that LP® SolidStart® laminated strand lumber (LSL), LP® SolidGuard® Laminated Strand Lumber (LSL) and LP® SolidStart® laminated veneer lumber (LVL), recognized in ICC-ES master report ESR-2403, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2020 and 2017 *Florida Building Code—Building*
- 2020 and 2017 *Florida Building Code—Residential*

2.0 CONCLUSIONS

The LP® SolidStart® LSL and LVL and LP® SolidGuard® LSL, described in Sections 2.0 through 7.0 of the master evaluation report ESR-2403, comply with the *Florida Building Code—Building* and the *Florida Building Code—Residential*, provided the design and installation are in accordance with the 2018 and 2015 *International Building Code®* provisions noted in the master report. However, Table 6 of the master report is not applicable.

Use of the LP® SolidStart® LSL and LVL for compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* and the *Florida Building Code—Residential* has not been evaluated and is outside the scope of this evaluation report.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality-assurance program is audited by a quality-assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official, when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the master report, reissued February 2019 and revised August 2020.