

**FRERES Mass Ply Panel (MPP), and
Mass Ply Lam (MPL) Beams and Columns
Freres Lumber Co., Inc.**

PR-L325(C)

Revised September 30, 2024

Products: Freres Mass Ply Panels (MPP) and Mass Ply Lam (MPL) Beams and Columns
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1. Basis of the product report:
 - 2020 National Building Code of Canada (NBC): Clause 1.2.1.1 of Division A and Clauses 4.1, 4.3.1.1, and 9.23 of Division B
 - CSA O86-19 Engineering Design in Wood
 - ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber
 - ANSI/APA PRG 320-2018 recognized in CSA O86-19
 - ASTM D5456-18 recognized in CSA O86-19
 - APA Reports T2018P-21, T2019P-39, T2019P-50, T2019P-69, T2020P-23, T2021P-18, T2021P-25, and T2021P-38, and other qualification data

2. Product description:

Freres Mass Ply Panels (MPP) are manufactured with nominal 25-mm-thick (1-inch-thick) Freres 1.6E or 1.0E Douglas-fir LVL recognized in APA Product Report PR-L324 in accordance with custom layouts of ANSI/APA PRG 320 through product qualification and mathematical models using principles of engineering mechanics. The LVL layers are parallel laminated, bonded with qualified structural adhesives, and pressed to form a solid panel. The unglued edge joints between the 25-mm-thick (1-inch-thick) LVL pieces within the same MPP layer, when present, are staggered between adjacent layers.

Freres MPP is available in the grade of F10 or F16, and can be used in floor, roof, and wall applications. Freres MPP is manufactured in a plank billet (see Figure 1) in nominal widths (w) of 1,219, 2,438, 3,048, and 3,658 mm (4, 8, 10, and 12 feet), nominal thicknesses (t) of 52 to 311 mm (2-1/16 to 12-1/4 inches), and lengths up to 14.6 m (48 feet).

Freres Mass Ply Lams (MPL) are rip-cut vertically from MPP and intended primarily for use as beams in the joist (edgewise) orientation or columns in the axial orientation. MPL is not permitted to be rip-cut horizontally from MPP. MPL is available in the grade of F21, F19, F16, F16A, or F10. Freres F21, F19, and F16 MPL are available in nominal thicknesses (t) of 52 to 622 mm (2-1/16 to 24-1/2 inches), nominal widths (w) of 25 to 1,219 mm (1 to 48 inches), and lengths up to 24.4 m (80 feet). Freres F21, F19, and F16 MPL are ripped from 1,219-mm (4-foot) wide MPP with no edge joints between any 25-mm (1-inch) layers. Freres F16 MPL is permitted for use in the plank (flatwise) orientation provided that the minimum width (w) is no less than 130 mm (5-1/8 inches).

Freres F16A MPL is available in nominal thicknesses (t) of 52 to 311 mm (2-1/16 to 12-1/4 inches), nominal widths (w) of 25 to 1,829 mm (1 to 72 inches), and lengths up to 24.4 m (80 feet) (see Figure 1). Freres F16A MPL shall be permitted to be ripped from an MPP billet as long as the distance between the edge joint in any 25-mm (1-inch) layers and extreme fiber in tension or compression edge of the MPL is at least 127 mm (5 inches). Freres F16A MPL is permitted for use in the plank (flatwise) orientation provided that the minimum width (w) is no less than 130 mm (5-1/8 inches).

Freres F10 MPL is available in nominal thicknesses (t) of 52 to 78 mm (2-1/16 to 3-1/16 inches), nominal widths (w) up to 1,219 mm (48 inches), and lengths up to 14.6 m (48 feet). Freres F10 MPL is ripped from 1,219-mm (4-foot) wide MPP with no edge joints between any 25-mm (1-inch) layers. Freres F10 MPL is permitted for use in the plank (flatwise) orientation provided that the minimum width (w) is no less than 130 mm (5-1/8 inches).

3. Design properties:

Freres MPP and MPL shall be designed with the design properties and capacities provided in Tables 1 and 2, respectively, or recommendations provided by the manufacturer. The design adjustment factors shall be in accordance with Chapter 8 of CSA O86 or based on the recommendations provided by the manufacturer and approved by the engineer of record. The lateral resistance of Freres MPP, when used as shear walls or diaphragms, shall be permitted to be designed in accordance with Clause 11.9 of CSA O86 in consultation with the manufacturer and approved by the engineer of record.

Table 3 lists the equivalent specific gravities for the fastener design and Table 4 lists the minimum nail spacing for Freres MPP and MPL.

4. Product installation:

Freres MPP and MPL shall be installed in accordance with the recommendations provided by the manufacturer and the engineering drawing approved by the engineer of record. Permissible details shall be in accordance with the engineering drawing.

5. Fire-rated assemblies:

Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer. Procedures specified in Annex B of CSA O86 shall be permitted for use in the fire design of Freres MPP and MPL.

6. Limitations:

- a) Freres MPP and MPL shall be designed in accordance with principles of engineering mechanics using the design properties specified in this report or provided by the manufacturer.
- b) Freres MPP and MPL products shall be limited to dry service conditions where the average equilibrium moisture content of solid-sawn lumber over a year is 15% or less and does not exceed 19%.
- c) Freres MPP and MPL shall be manufactured in accordance with proprietary Freres MPP and MPL manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
- d) Freres MPP and MPL are produced at the Freres facility in Lyons, Oregon under a quality assurance program audited by APA.
- e) Properties shown in Table 2 are limited to F21, F19, F16, and F16A MPL with nominal thicknesses of 52 to 622 mm (2-1/16 to 24-1/2 inches), and F10 MPL with nominal thicknesses of 52 to 78 mm (2-1/16 to 3-1/16 inches).
- f) The distance between the edge joint in any 25-mm (1-inch) layers and extreme fiber in tension or compression edge of the MPL must be at least 127 mm (5 inches) when installed in the joist (edgewise) orientation.
- g) This report is subject to re-examination in one year.

7. Identification:

Freres MPP and MPL described in this report are identified by a label (stamp or sticker) bearing the manufacturer's name (Freres) and/or trademark, the APA assigned plant number (1121), the product standard (ANSI/APA PRG 320 and/or ASTM D5456), the APA logo, the MPP or MPL grade and thickness (or layout ID), the report number PR-L325 (or PR-L325C), and a means of identifying the date of manufacture.

Table 1. LSD Flatwise Bending Stiffness and Unfactored Resistance Values^(a,b,c) for Freres MPP (for Use in Canada)

MPP Grade ^(d)	Layup ID	Thickness, t _p (mm)	Major Strength Direction				Minor Strength Direction			
			(F _b S) _{eff,f,0} (10 ⁶ N-mm/m)	(EI) _{eff,f,0} (10 ⁹ N-mm ² /m)	(GA) _{eff,f,0} (10 ⁶ N/m)	V _{s,0} (kN/m)	(F _b S) _{eff,f,90} (10 ⁶ N-mm/m)	(EI) _{eff,f,90} (10 ⁹ N-mm ² /m)	(GA) _{eff,f,90} (10 ⁶ N/m)	V _{s,90} (kN/m)
F16	F16-2	52	9.1	151	12	59	0.61	4.4	0.44	19
	F16-3	78	15	480	18	59	1.8	43	4.1	19
	F16-4	104	27	1,149	23	79	4.2	151	6.0	25
	F16-5	130	43	2,241	31	98	7.4	348	8.0	31
	F16-6	155	62	3,860	36	118	12	678	10.0	37
	F16-7	181	84	6,139	39	138	14	876	11	44
	F16-8	207	110	9,161	44	157	19	1,393	13	50
	F16-9	233	139	13,040	50	177	24	2,081	15	56
	F16-10	259	171	17,888	55	197	31	2,966	16	62
	F16-11	285	207	23,810	61	216	38	4,067	19	68
	F16-12	311	246	30,909	67	236	46	5,414	20	74
	F10	F10-2	52	5.5	69	5.5	35	1.4	21	1.6
F10-3		78	12	235	8.5	41	4.8	113	5.8	26
F10-4		104	22	546	11	55	11	367	8.8	35
F10-5		130	35	1,073	14	69	13	697	8.9	44
F10-6		155	50	1,855	18	82	20	1,356	11	53
F10-7		181	68	2,937	19	96	29	2,344	13	62
F10-8		207	88	4,387	22	110	36	2,740	16	71
F10-9		233	112	6,252	25	123	47	4,086	18	80
F10-10		259	138	8,568	28	137	60	5,818	20	88
F10-11		285	167	11,411	31	151	74	7,984	22	97
F10-12		311	199	14,810	34	165	90	10,629	25	106

For Imperial: 1 mm = 0.0394 in.; 1 m = 3.28 ft; 1 N = 0.2248 lbf

- (a) Tabulated values are unfactored Limit States design values and not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86.
- (b) Tabulated values are limited to F16 and F10 MPP manufactured with 25-mm-thick (1-inch-thick) Freres 1.6E and 1.0E Douglas-fir LVL, respectively, as recognized in APA Product Report PR-L324.
- (c) Deflection under a specified uniformly distributed load, *w*, acting perpendicular to the face of a single-span MPP panel shall be permitted to be calculated as a sum of the deflections due to moment and shear effects using the effective bending stiffness, (EI)_{eff}, and the effective in-plane (planar) shear rigidity, (GA)_{eff}, as follows:

$$\delta = \frac{5wL^4}{384(EI)_{eff}} + \frac{wL^2}{8000(GA)_{eff}} \quad [1]$$

where: δ = estimated deflection, mm; w = uniform load, N/m²;
L = span, m; $(EI)_{eff}$ = tabulated effective bending stiffness, 10⁹ N-mm²/m; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10⁶ N/m.

For a concentrated load, P, located in the middle of a single span MPP panel acting perpendicular to the panel, the deflection shall be permitted to be calculated as follows:

$$\delta = \frac{PL^3}{48(EI)_{eff}} + \frac{PL}{4000(GA)_{eff}} \quad [2]$$

where: δ = estimated deflection, mm; P = concentrated load, N/m of width;
L = span, m; $(EI)_{eff}$ = tabulated effective bending stiffness, 10⁹ N-mm²/m; and
 $(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10⁶ N/m.

(d) The MPP grade and layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

Table 2. Specified Strengths and MOE (LSD for Use in Canada) for Freres MPL^(a,b)

Property		Design Stress			
		F21	F19	F16A and F16	F10
Flexural Stress (f_b) ^(c) MPa (psi)	Joist ^(d)	35.7 (2,800)	27.4 (2,150)	24.0 (1,900)	12.1 (950)
	Plank	NA	NA	15.9 (1,250) ^(g)	12.3 (965)
Modulus of Elasticity (E) ^(e) MPa (psi)	Joist	14,480 (2.1×10^6)	13,101 (1.9×10^6)	11,032 (1.6×10^6)	6,206 (0.9×10^6)
	Plank	NA	NA	9,653 (1.4×10^6)	5,861 (0.85×10^6)
Horizontal Shear (f_v) MPa (psi)	Joist	3.3 (260)	3.4 (265)	3.7 (285) ^(h)	3.8 (300)
	Plank	NA	NA	0.97 (90) ⁽ⁱ⁾	0.34 (40)
Compression Perpendicular to Grain (f_{cp}) MPa (psi)	Joist	9.4 (750)	9.4 (750)	9.4 (750)	9.4 (750)
	Plank	NA	NA	6.2 (500)	6.2 (500)
Tension parallel to grain (f_t) ^(f) MPa (psi)		22.3 (1,750)	19.8 (1,550)	16.6 (1,300)	2.0 (200)
Compression Parallel to grain (f_c) MPa (psi)		31.9 (2,900)	26.7 (2,425)	26.4 (2,400)	17.1 (1,550)

- (a) The tabulated values are specified strengths and modulus of elasticity for standard-term load duration. All values, except for E and f_{cp} , are permitted to be adjusted for other load durations as permitted by the code. The tabulated values are limited to dry service conditions.
- (b) Joist = load parallel to glueline, plank = load perpendicular to glueline (see Figure 1 for available thicknesses).
- (c) The tabulated flexural stress (f_b) may be increased by 4 percent when members are used in a load-sharing system as defined in the CSA O86 15.3.2.4.
- (d) The tabulated values 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 $(305/d)^{1/6}$, where d = member 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) Apparent modulus of elasticity.
- (f) The tabulated values are based on a reference length of 1,219 mm (4 feet). For lengths longer than 1,219 mm (4 feet), the allowable tensile stress shall be modified by $(1,219/L)^{1/7}$, where L = member length in mm. For lengths shorter than 1,219 mm (4 feet), use the tabulated value unadjusted.
- (g) The tabulated value can be increased to 17.5 MPa (1,650 psi) for 52 mm (2-1/16 inches) in thickness.
- (h) The tabulated value for F16A shall be multiplied by 0.3 for 3-ply members, 0.4 for all other odd-ply members, and 0.5 for all even-ply members.
- (i) For beams equal to or greater than 152 mm (6 inches) in depth, the tabulated value shall be reduced to 0.70 MPa (55 psi).

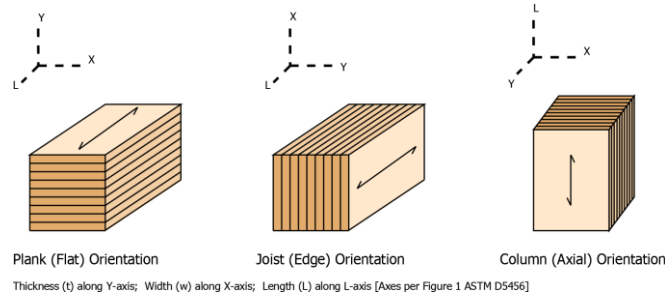
Table 3. Equivalent Specific Gravity for Fastener Design of Freres MPP and MPL

Grade	Equivalent Specific Gravity (ESG)					
	Nails and Wood Screws				Bolts and Lag Screws	
	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
F21	0.49	0.50	0.49	0.60	0.54	0.59
F19	0.40	0.50	0.49	0.59	0.52	0.63
F16A and F16	0.42	0.50	0.41	0.62	0.42	0.63
F10	0.42	0.50	0.34	0.58	0.41	0.63

Table 4. Minimum Allowable Nail Spacings for Freres MPP and MPL^(a,b)

Orientation	Common Nail Size ^(c,d)	Minimum End Distance mm (in.)	Minimum Nail Spacing mm (in.)	
			Single Row	Multiple Rows
Edge ^(e)	83 mm (3-1/4 in.) (12d) & smaller	38 (1-1/2)	76 (3)	NR ^(g)
	89 mm (3-1/2 in.) (16d)	NR ^(g)		
Face ^(f)	89 mm (3-1/2 in.) (16d) & smaller	25 (1)	51 (2)	51 (2)

- (a) Edge distance shall be sufficient to prevent splitting.
- (b) The tabulated values are limited to MPP and MPL with a thickness of 52 mm (2-1/16 inches) or thicker.
- (c) 83 mm (3-1/4 in.) (16d sinkers) may be spaced the same as an 83 mm (3-1/4 in.) 12d common wire nail.
- (d) Nails listed are common wire nails. For box nails, the spacing and end distance requirements of the next shorter common nails may be used: e.g., an 89 mm (3-1/2 in.) 16d box nail may be spaced the same as an 83 mm (3-1/4 in.) 12d common nail. Fastener sizes and closest on-center spacing not specifically described above are beyond the scope of this report.
- (e) Nail penetration for edge nailing shall not exceed 64 mm (2-1/2 in.) for 83 mm (3-1/4 in.) 12d common nails and 57 mm (2-1/4 in.) for 64 mm (2-1/2 in.) 8d common nails.
- (f) Tabulated closest on-center spacing for face orientation is applicable to nails that are installed in rows parallel to the grain (length) of the MPP and MPL. For nails installed in rows perpendicular to the direction of grain (width/depth) of the MPP and MPL, the closest on-center spacing for face orientation shall be sufficient to prevent splitting of the MPP and MPL.
- (g) Not recommended.



Plies	2	3	4	5	6	7	8	9	10	11	12	
Thickness mm (in.)	52 (2 1/16 or 2.04)	78 (3 1/16 or 3.06)	104 (4 1/16 or 4.08)	130 (5 1/8 or 5.10)	155 (6 1/8 or 6.12)	181 (7 1/8 or 7.14)	207 (8 3/16 or 8.16)	233 (9 3/16 or 9.18)	259 (10 3/16 or 10.20)	285 (11 1/4 or 11.22)	311 (12 1/4 or 12.24)	
Plies	13	14	15	16	17	18	19	20	21	22	23	24
Thickness mm (in.)	337 (13 1/4 or 13.26)	363 (14 1/4 or 14.28)	389 (15 5/16 or 15.30)	415 (16 5/16 or 16.32)	440 (17 3/8 or 17.34)	466 (18 3/8 or 18.36)	492 (19 3/8 or 19.38)	518 (20 3/8 or 20.40)	544 (21 7/16 or 21.42)	570 (22 7/16 or 22.44)	596 (23 1/2 or 23.46)	622 (24 1/2 or 24.48)

Legends: Thickness available for F10, F16, F16A, F19, and F21 Thickness available for F16, F16A, F19, and F21 Thickness available for F16, F19, and F21.

Figure 1. Freres MPP and MPL Orientations and Thicknesses

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