

Nordic Lam™
Nordic Structures

PR-L294

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Products: Nordic Lam™

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1. Basis of the product report:

- 2018, 2015, and 2012 International Building Code (IBC): Sections 104.11 Alternative materials and 2303.1.3 Structural glued-laminated timber
- 2018 and 2015 International Residential Code (IRC): Sections R104.11 Alternative materials, and R502.1.3, R602.1.3, and R802.1.2 Structural glued-laminated timber
- 2012 IRC: Sections R104.11 Alternative materials, and R502.1.5, R602.1.2, and R802.1.4 Structural glued-laminated timber
- ASTM D3737-12 and D3737-08 recognized by the 2018 and 2015 IBC and IRC, and 2012 IBC and IRC, respectively
- ANSI A190.1-2017, ANSI A190.1-2012, and ANSI/AITC A190.1-2007 recognized by the 2018 IBC and IRC, 2015 IBC and IRC, and 2012 IBC and IRC, respectively
- ANSI 117-2015 recognized by the 2018 IBC and IRC, and AITC 117-10 recognized by the 2015 IBC and 2012 IBC
- APA Reports T2001P-85, T2003P-21, T2004P-43, T2005P-74, T2006P-45, T2008P-91, T2009P-39, and T2012P-41, FPInnovations Reports 201003404, 201003409, 201005209, 301008842, 301009694, and 301011496, and other qualification data

2. Product description:

Nordic Lam™ is structural glued laminated timber (glulam) manufactured with Spruce-Pine-Fir (mainly Black Spruce) lumber in accordance with layup combinations developed in accordance with the principle of ASTM D3737. Nordic Lam is used as beams, headers, rafters, purlins, columns, studs, and decking, and is manufactured in nominal widths ranging from 1-1/2 to 27 inches, a variety of depths, and lengths up to 80 feet, in accordance with Table 1.

3. Design properties:

Table 2 lists the allowable design properties for Nordic Lam beams. The allowable spans for Nordic Lam beams shall be in accordance with the recommendations provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents/ns-gt5-us), and APA Data File: *Glued Laminated Beam Design Tables*, Form S475 (www.apawood.org/resource-library), as applicable.

Table 3 lists the allowable design properties for Nordic Lam columns. The allowable loads for Nordic Lam columns shall be in accordance with the recommendations provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents/ns-gt5-us), and APA Data File: *Design of Structural Glued Laminated Timber Columns*, Form Y240 (see link above), as applicable.

Design values for the Load and Resistance Factor Design (LRFD) used in the U.S. for Nordic Lam beams and columns can be derived from the ASD values published in Tables 2 and 3 of this report in accordance with Tables 5.3.1, N1, N2, and N3 of the 2018 National Design Specification for Wood Construction (NDS).

4. Product installation:
Nordic Lam beams and columns shall be installed in accordance with the recommendations provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents/ns-gt5-us) and APA Technical Note: *Glulam Connection Details*, Form T300 (see link above). Permissible field notching and drilling of Nordic Lam beams shall be in accordance with the recommendations provided by the manufacturer and APA Technical Notes: *Field Notching and Drilling of Glued Laminated Timber Beams*, Form S560, and *Effect of Large Diameter Horizontal Holes on the Bending and Shear Properties of Structural Glued Laminated Timber*, Form V700 (see link above). Permissible field notching and drilling of Nordic Lam columns shall be in accordance with the recommendations provided by the manufacturer.

5. Fire-rated assemblies:
Fire-rated assemblies shall be constructed in accordance with the recommendations provided by the manufacturer (see link above). Procedures specified in Chapter 16 of the 2018 NDS shall be permitted for use in designing glulams exposed to fire up to 2 hours. 1,350F_b-1.6E/ES1 Nordic Lam beams with a minimum net depth of 9-1/4 inches meet the 2x10 lumber criteria specified in Exception 4 of Sections R302.13 of the 2018 and 2015 IRC and R501.3 of the 2012 IRC, *Fire Protection of Floors*.

Nordic Lam has been tested in accordance with ASTM E84 and meets the Class B rating for flame spread index (26 – 75) and smoke-developed index (0 – 450).

6. Limitations:
 - a) Nordic Lam beams and columns shall be designed in accordance with the code using the design properties specified in this report.
 - b) The dimensions of Nordic Lam beams and columns shall follow those specified in Table 1.
 - c) Nordic Lam beams and columns shall be manufactured in accordance with layup combinations specified in ANSI 117 or proprietary Nordic Lam manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
 - d) Nordic Lam is produced at the Nordic Structures, Chibougamau, Quebec facilities under a quality assurance program audited by APA.
 - e) This report is subject to re-examination in one year.

7. Identification:
Nordic Lam described in this report is identified by a label bearing the manufacturer's name (Nordic Structures) and/or trademark, the APA assigned plant number (1057), the product standard (ANSI A190.1), the APA logo, the combination symbol, the report number PR-L294, and a means of identifying the date of manufacture.

Table 1. Dimensions for Nordic Lam layups.

Layup	Minimum width (in.)	Maximum width (in.)	Minimum depth	Maximum depth (in.)
1,350F _b -1.6E/ES1	1-1/2	1-1/2	7-1/8 in.	15
20F-E8M1	1-1/2	7-1/2	4 lams	18
20F-ES/CPG	3-1/8 ⁽¹⁾	3-1/2	4 lams	18
24F-E/ES1M1	1-1/2	7-1/2	4 lams	36 ⁽²⁾
24F-ES/MSR	3-1/8	3-1/2	4 lams	36 ⁽²⁾
24F-ES/NPG	1-1/2	27	4 lams	NA ⁽²⁾
ES11	1-1/2	7-1/2	2 lams	15
ES11/NPG	1-1/2	7-1/2	2 lams	15
ES12	1-1/2	7-1/2	2 lams	15
ES12/NPG	1-1/2	27	2 lams	54 ⁽²⁾

⁽¹⁾ The minimum width shall be permitted to be 1-1/2 inches when 24F-ES/NPG is trademarked as 20F-ES/CPG.

⁽²⁾ The maximum depth shall not exceed the tabulated depth or a depth-to-width ratio of 12:1, whichever is smaller.

Table 2. Allowable Design Values for Nordic Lam Beams for Normal Duration of Load⁽¹⁾

Symbol	Species Outer/Core ⁽³⁾ (Bal or Unbal ⁽⁴⁾)	Bending About X-X Axis (Loaded Perpendicular to Wide Faces of Laminations)								Bending About Y-Y Axis (Loaded Parallel to Wide Faces of Laminations)						Axially Loaded		Fasteners	
		Extreme Fiber in Bending ⁽⁵⁾		Compression Perpendicular to Grain		Shear Parallel to Grain ⁽⁶⁾	Modulus of Elasticity ⁽⁷⁾			Extreme Fiber in Bending ⁽⁸⁾	Comp. Perpendicular to Grain	Shear Parallel to Grain ⁽⁶⁾	Modulus of Elasticity ⁽⁷⁾			Tension Parallel to Grain	Comp. Parallel to Grain	Specific Gravity for Dowel-Type Fastener Design	
		Bottom of Beam Stressed in Tension (Positive Bending)	Top of Beam Stressed in Tension (Negative Bending)	Ten. Face	Comp. Face		True	Apparent	Beam Stability				True	Apparent	Beam Stability			Top or Bottom Face	Side Face
		F_{bx}^+ (psi)	F_{bx}^- (psi)	F_{cLx} (psi)		F_{vx} (psi)	E_x^{true} (10 ⁶ psi)	E_x^{app} (10 ⁶ psi)	E_x^{min} (10 ⁶ psi)	F_{by} (psi)	F_{cLy} (psi)	F_{vy} (psi)	E_y^{true} (10 ⁶ psi)	E_y^{app} (10 ⁶ psi)	E_y^{min} (10 ⁶ psi)	F_t (psi)	F_c (psi)	SG	
1,350F _b -1.6E/ES ₁ ⁽⁹⁾	ES/ES (B)	1,350 ⁽¹⁰⁾	1,350 ⁽¹⁰⁾	450	450	250	1.7	1.6	0.85	NA	NA	NA	NA	NA	NA	NA	0.41	0.41	
20F-E8M1	ES/ES (B)	2,000	2,000	450	450	250	1.6	1.5	0.79	1050	315	175	1.5	1.4	0.74	800	1,000	0.41	0.41
20F-ES/CPG	ES/ES (B)	2,000	2,000	450	450	250	1.9	1.8	0.95	2,000	450	250	1.9	1.8	0.95	800	1,000	0.41	0.41
24F-E/ES1M1	ES/ES (B)	2,400	2,400	600 ⁽¹¹⁾	600 ⁽¹¹⁾	250	1.9	1.8	0.95	1,100	300	175	1.6	1.5	0.79	1,050	1,150	0.41	0.41
24F-ES/MSR	ES/ES (B)	2,400	2,400	600 ⁽¹¹⁾	600 ⁽¹¹⁾	250	1.9	1.8	0.95	1,100	300	175	1.6	1.5	0.79	1,050	1,150	0.41	0.41
24F-ES/NPG	ES/ES (B)	2,400	2,400	600 ⁽¹¹⁾	600 ⁽¹¹⁾	300	1.9	1.8	0.95	2,400	600 ⁽¹¹⁾	300	1.9	1.8	0.95	1,600	2,300	0.46	0.46
Wet-use factor		0.8		0.53		0.875	0.833			0.8	0.53	0.875	0.833			0.8	0.73	see NDS	

⁽¹⁾ The combinations in this table are intended primarily for members stressed in bending due to loads applied perpendicular to the wide faces of the laminations. Allowable design values are tabulated, however, for loading both perpendicular and parallel to the wide faces of the laminations.

⁽²⁾ The tabulated allowable design values are for normal duration of loading. For other durations of loading, see the applicable building code. The tabulated allowable design values are for dry conditions of use. For wet conditions of use, multiply the tabulated values by the wet-use factors shown at the bottom of the table.

⁽³⁾ ES = Eastern spruce.

⁽⁴⁾ The unbalanced (U) layout is intended primarily for simple-span applications and the balanced (B) layout is intended primarily for continuous or cantilevered applications.

⁽⁵⁾ The values of F_{bx} are based on members 5-1/8 inches in width by 12 inches in depth by 21 feet in length. For members with a larger volume, F_{bx} shall be multiplied by a volume factor, $C_v = (5.125/b)^{1/10} (12/d)^{1/10} (21/L)^{1/10}$, where b is the beam width (in.), d is the beam depth (in.), and L is the beam length between the points of zero moment (ft).

⁽⁶⁾ For non-prismatic members, members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the F_{vx} and F_{vy} values shall be multiplied by a factor of 0.72.

⁽⁷⁾ The tabulated E values include true E (also known as "shear-free E"), apparent E, and E for beam stability calculation (NDS 3.3.3.8). For calculating beam deflections, the tabulated E_{app} values shall be used unless the shear deflection is determined in addition to bending deflection based on the tabulated E_{true} . The axial modulus of elasticity, E_{axial} and $E_{axial min}$, shall be equal to the tabulated E_y^{true} and E_y^{min} values.

⁽⁸⁾ The values of F_{by} are based on members 12 inches in depth. For depths less than 12 inches, F_{by} shall be permitted to be increased by multiplying by the flat-use factor, $(12/d)^{1/9}$, where d is the beam depth in inches. When d is less than 3 inches, use the flat-use factor for 3 inches.

⁽⁹⁾ This layout is limited to 1-1/2 inches in width and 7-1/8 inches through 15 inches in depth.

⁽¹⁰⁾ The values of F_{bx} are based on members 1-1/2 inches in width by 12 inches in depth. For members with other depths, F_{bx} shall be multiplied by an adjustment factor of $(12/d)^{1/9}$ in lieu of the typical volume factor used for glulam, as shown in Footnote 5.

⁽¹¹⁾ The F_{cL} value is applicable to glulam members made with manufactured lumber. Otherwise, the F_{cLx} value shall be 560 psi.

Table 3. Allowable Design Values for Nordic Lam Columns for Normal Duration of Load⁽¹⁾

Combination Symbol	Species ⁽²⁾	Grade	All Loading				Axially Loaded			Bending about Y-Y Axis				Bending about X-X Axis		Fasteners Specific Gravity for Dowel-Type Fastener Design SG
			Modulus of Elasticity ⁽³⁾			Compression Perpendicular to Grain F_{cL} (psi)	Tension Parallel to Grain F_t (psi)	Compression Parallel to Grain		Loaded Parallel to Wide Faces of Laminations			Loaded Perpendicular to Wide Faces of Laminations			
			E_{x true}, E_{y true} or E_{axial} (10 ⁶ psi)	E_{x app} or E_{y app} (10 ⁶ psi)	E_{x min}, E_{y min} or E_{axial min} (10 ⁶ psi)			2 or More Lams	4 or More Lams	2 or 3 Lams	Bending ⁽⁴⁾			Shear Parallel to Grain ^(5,6)	Bending ⁽⁷⁾ 2 Lams to 15 in. Deep	
						4 or More Lams	3 Lams				2 Lams					
F_{by} (psi)	F_{by} (psi)	F_{by} (psi)	F_{vy} (psi)	F_{bx} (psi)	F_{vx} (psi)											
ES 11	ES	C4	1.6	1.5	0.79	450	975	1,550	1,350	1,750	1,600	1,400	175	1,350 ⁽⁸⁾	250	0.41
ES 11/NPG	ES	NPG	1.6	1.5	0.79	450	975	1,550	1,350	1,750	1,600	1,400	175	1,350	250	0.41
ES 12	ES	1.9E6	1.9	1.8	0.95	600 ⁽⁹⁾	1,600	2,300	1,700	2,400	2,400	2,300	175	1,950 ⁽⁸⁾	250	0.46
ES 12/NPG	ES	NPG	1.9	1.8	0.95	600 ⁽⁹⁾	1,600	2,300	1,700	2,400	2,400	2,300	300	2,400	300	0.46
Wet-use factors			0.833			0.53	0.8	0.73		0.8			0.875	0.8	0.875	see NDS

⁽¹⁾ The tabulated allowable design values are for normal duration of loading. For other durations of loading, see applicable building code. The tabulated allowable design values are for dry conditions of use. For wet conditions of use, multiply the tabulated values by the factors shown at the bottom of the table.

⁽²⁾ ES = Eastern spruce.

⁽³⁾ The tabulated E values include axial modulus of elasticity for column stability calculation (E_{axial min}, NDS 3.7.1). For calculating column deflections due to lateral loads, the tabulated E_{x app} or E_{y app} values shall be used unless the shear deflection is determined in addition to bending deflection based on the tabulated E_{x true} or E_{y true}.

⁽⁴⁾ The values of F_{by} are based on members 12 inches in depth. For depths less than 12 inches, F_{by} shall be permitted to be increased by multiplying by the size factor, (12/d)^{1/9}, where d is the beam depth in inches. When d is less than 3 inches, use the size adjustment factor for 3 inches.

⁽⁵⁾ For non-prismatic members, notched members, members subject to impact or cyclic loading, or shear design of bending members at connections (NDS 3.4.3.3), the tabulated F_{vx} and F_{vy} values shall be multiplied by 0.72.

⁽⁶⁾ The tabulated F_{vy} values are for members of 4 or more lams. The tabulated F_{vy} values shall be multiplied by a factor of 0.95 for 3 lams and 0.84 for 2 lams.

⁽⁷⁾ The values of F_{bx} are based on members 5-1/8 inches in width by 12 inches in depth by 21 feet in length. For members with a larger volume, F_{bx} shall be multiplied by a volume factor, C_v = (5.125/b)^{1/10} (12/d)^{1/10} (21/L)^{1/10}, where b is the beam width (in.), d is the beam depth (in.), and L is the beam length between the points of zero moment (ft).

⁽⁸⁾ When the member depth is greater than 15 inches, the tabulated F_{bx} values shall be multiplied by a factor of 0.88.

⁽⁹⁾ The F_{cL} value is applicable to glulam members made with manufactured lumber. Otherwise, the F_{cL} value shall be 560 psi for ES 12 and ES 12/NPG.

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