

Nordic Lam[™] Nordic Structures

PR-L294(C)

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Products: Nordic Lam[™]

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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, 9.23.4.2, and 9.23.10.1 of Division B
 - CSA O86-19 Engineering Design in Wood
 - CSA O122-16 Structural Glued Laminated Timber recognized in CSA O86-19
 - CSA O177-06 (R2015) Qualification Code for Manufacturers of Structural Glued-Laminated Timber recognized in CSA O86-19
 - APA Reports T2001P-85, T2003P-21, T2004P-43, T2005P-74, T2006P-45, T2008P-91, T2009P-39, and T2012P-41, FPIInnovations 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, ASTM D7341 and full-scale tests. The end joints within the Nordic Lam are randomly spaced within the same lamination and are not required to be spaced a minimum of 1.8 m (71 inches) apart. Nordic Lam is used as beams, headers, rafters, purlins, columns, studs, and decking, and is manufactured in nominal widths ranging from 38 to 686 mm (1-1/2 to 27 inches), a variety of depths, and lengths up to 24.4 meters (80 feet), in accordance with Table 1.
3. Design properties:

Table 2 lists the engineering properties for Nordic Lam beams. The maximum design loads for Nordic Lam beams shall be in accordance with the recommendations provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents/ns-gt5-ca).

Table 3 lists the engineering properties for Nordic Lam columns. The maximum design 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-ca).
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-ca) and APA Construction Guide: *Glulam Connection Details*, Form T300 (www.apawood.org/resource-library). 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 Annex B of the 2019 CSA O86 may be considered in designing glulams exposed to fire up to 2 hours when permitted by the authority having jurisdiction. The fire-resistance rating shall be evaluated in accordance with Appendix D-2.11 of the 2020 NBC.

Nordic Lam has been tested in accordance with CAN/ULC S102 and meets the flame-spread rating of 0 – 25 and smoke developed classification of 0 – 450 when the glulam depth is at least 86 mm (3.4 inches). The flame-spread rating of 26 – 75 and smoke developed classification of 0 – 450 shall be applicable to Nordic Lam with a depth that is less than 86 mm (3.4 inches). These values apply to Nordic Lam without surface treatment (e.g., protective coatings, sealants, primers, stains, etc.). For flame-spread ratings and smoke developed classifications with a surface treatment, refer to the manufacturer.

6. Limitations:

- a) Nordic Lam beams and columns shall be designed in accordance with the code using the engineering 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, *Standard Specification for Structural Glued Laminated Timber of Softwood Species*, 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 APA logo, the combination symbol, the report number PR-L294 or PR-L294C, and a means of identifying the date of manufacture.

Table 1. Dimensions for Nordic Lam layups

Layup	Minimum width, b (mm)	Maximum width, b (mm)	Minimum depth	Maximum depth, h (mm)
20F-E8M1	38	191	4 lams	457
20F-ES/CPG	79 ⁽¹⁾	89	4 lams	457
24F-E/ES1M1	38	191	4 lams	914 ⁽²⁾
24F-ES/MSR	79	89	4 lams	914 ⁽²⁾
24F-ES/NPG	38	686	4 lams	NA ⁽²⁾
ES11	38	191	2 lams	381
ES11/NPG	38	191	2 lams	381
ES12	38	191	2 lams	381
ES12/NPG	38	686	2 lams	1,372 ⁽²⁾

⁽¹⁾ The minimum width shall be permitted to be 38 mm 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. Specified Strengths (MPa) and Relative Density for Nordic Lam Beams^(1,2,3)

Stress grade	20F-1.9E	20F-1.6E	24F-1.9E	24F-1.9E	24F-1.9E	Wet- Use Factor
EWS combination layup symbol ⁽⁹⁾	20F- ES/CPG	20F- E8M1	24F- E/ES1M1	24F- ES/NPG	24F- ES/MSR	
<i>Bending about X-X Axis (Loaded Perpendicular to Wide Faces of Laminations)</i>						
Bending at extreme fibre due to positive bending moment (F_{bx}^{+}) ⁽⁷⁾	25.6	25.6	30.7	30.7	30.7	0.80
Bending at extreme fibre due to negative bending moment (F_{bx}^{-}) ⁽⁷⁾	25.6	25.6	30.7	30.7	30.7	0.80
Longitudinal shear (F_{vx}) ^(4,8)	2.2	2.2	2.2	2.5	2.2	0.87
Compression perpendicular to grain ($F_{cp\!x}$) ⁽¹⁰⁾						
Compression face	5.8	5.8	7.5 ⁽⁶⁾	7.5 ⁽⁶⁾	7.5 ⁽⁶⁾	0.67
Tension face	5.8	5.8	7.5 ⁽⁶⁾	7.5 ⁽⁶⁾	7.5 ⁽⁶⁾	0.67
True Modulus of Elasticity (E_x)	13,100	11,000	13,100	13,100	13,100	0.90
Apparent Modulus of Elasticity ($E_{x,app}$) ⁽⁵⁾	12,400	10,300	12,400	12,400	12,400	0.90
<i>Bending about Y-Y Axis(Loaded Parallel to Wide Faces of Laminations)</i>						
Bending at extreme fibre due to Positive Bending Moment (F_{by}^{+}) ⁽⁷⁾	25.6	13.4	14.1	30.7	14.1	0.80
Bending at extreme fibre due to Negative Bending Moment (F_{by}^{-}) ⁽⁷⁾	25.6	13.4	14.1	30.7	14.1	0.80
Longitudinal shear (F_{vy}) ⁽⁴⁾	2.2	1.5	1.5	2.5	1.5	0.87
Compression perpendicular to grain ($F_{cp\!y}$)						
Compression face	5.8	3.9	3.8	7.5 ⁽⁶⁾	3.8	0.67
Tension face	5.8	3.9	3.8	7.5 ⁽⁶⁾	3.8	0.67
True Modulus of Elasticity (E_y)	13,100	10,300	11,000	13,100	11,000	0.90
Apparent Modulus of Elasticity ($E_{y,app}$) ⁽⁵⁾	12,400	9,700	10,300	12,400	10,300	0.90
<i>Axially Loaded</i>						
Compression parallel to grain (F_c)	14.4	14.4	16.5	33.0	16.5	0.75
Tension parallel to grain (F_t)	10.2	10.2	13.4	20.4	13.4	0.75
Tension perpendicular to grain (F_{tp})	0.51	0.51	0.51	0.51	0.51	0.85
Modulus of elasticity (E_{axial})	13,100	9,700	11,000	13,100	11,000	0.90
<i>Connections Design</i>						
Mean oven-dry relative density (G)	0.42	0.42	0.42	0.47	0.42	—

⁽¹⁾ The combinations in this table are applicable to members consisting of 4 or more laminations, unless otherwise noted.

⁽²⁾ Design of glulam members shall be in accordance with CSA O86, Engineering Design in Wood (Limit States Design).

⁽³⁾ The tabulated design values are for standard-term load duration and dry conditions of use. For other load durations, see applicable design code. For wet conditions of use, multiply the tabulated values by the wet-use factors shown in the rightmost column of the table.

⁽⁴⁾ Specified longitudinal shear has been adjusted to a 2.0 m³ of beam volume.

⁽⁵⁾ The tabulated apparent E values have already included a 5% shear deflection.

⁽⁶⁾ The F_{cp} value is applicable to glulam members made with manufactured lumber. Otherwise, the F_{cp} value shall be 7.0 MPa.

⁽⁷⁾ In calculating the size factor for bending, K_{zb} , the beam width, b, must be taken as the full member width (mm).

⁽⁸⁾ In calculating the factored fracture shear resistance at a notch on the tension side at a support, F_r , the effective lamination width, b_{eff} , must be taken as the beam width (mm).

⁽⁹⁾ ES = Eastern spruce.

⁽¹⁰⁾ In calculating the size factor for bearing, K_{zcp} , the beam width, b, must be taken as the full member width (mm).

Table 3. Specified Strengths (MPa) and Relative Density for Nordic Lam Columns^(1,2,3)

Stress grade	ES11	ES11	ES12	ES12	Wet-Use Factor
EWS combination layup symbol ⁽⁸⁾	EWS ES11	ES11/NPG	EWS ES12	ES12/NPG	
Bending about X-X Axis (Loaded Perpendicular to Wide Faces of Laminations)					
Bending at extreme fibre due to positive bending moment (F _{bx} ⁺) ⁽⁹⁾	17.2 ⁽⁶⁾	17.2	24.9 ⁽⁶⁾	30.7	0.80
Bending at extreme fibre due to negative bending moment (F _{bx} ⁻) ⁽⁹⁾	17.2 ⁽⁶⁾	17.2	24.9 ⁽⁶⁾	30.7	0.80
Longitudinal shear (F _{vx}) ^(4,10)	2.2	2.2	2.2	2.5	0.87
Compression perpendicular to grain (F _{cp}) ⁽¹¹⁾					
Compression face	5.8	5.8	7.5 ⁽⁷⁾	7.5 ⁽⁷⁾	0.67
Tension face	5.8	5.8	7.5 ⁽⁷⁾	7.5 ⁽⁷⁾	0.67
True Modulus of Elasticity (E _x)	11,000	11,000	13,100	13,100	0.90
Apparent Modulus of Elasticity (E _{x,app}) ⁽⁵⁾	10,300	10,300	12,400	12,400	0.90
Bending about Y-Y Axis (Loaded Parallel to Wide Faces of Laminations)					
Bending at extreme fibre due to Positive Bending Moment (F _{by} ⁺)	22.4 (4+ lams) 20.4 (3 lams) 17.9 (2 lams)	22.4 (4+ lams) 20.4 (3 lams) 17.9 (2 lams)	30.7 (4+ lams) 30.7 (3 lams) 29.4 (2 lams)	30.7 (4+ lams) 30.7 (3 lams) 29.4 (2 lams)	0.80
Bending at extreme fibre due to Negative Bending Moment (F _{by} ⁻)	22.4 (4+ lams) 20.4 (3 lams) 17.9 (2 lams)	22.4 (4+ lams) 20.4 (3 lams) 17.9 (2 lams)	30.7 (4+ lams) 30.7 (3 lams) 29.4 (2 lams)	30.7 (4+ lams) 30.7 (3 lams) 29.4 (2 lams)	0.80
Longitudinal shear (F _{vy}) ⁽⁴⁾	1.5	1.5	1.5	2.5	0.87
Compression perpendicular to grain (F _{cpy})					
Compression face	5.8	5.8	7.5 ⁽⁷⁾	7.5 ⁽⁷⁾	0.67
Tension face	5.8	5.8	7.5 ⁽⁷⁾	7.5 ⁽⁷⁾	0.67
True Modulus of Elasticity (E _y)	11,000	11,000	13,100	13,100	0.90
Apparent Modulus of Elasticity (E _{y,app}) ⁽⁵⁾	10,300	10,300	12,400	12,400	0.90
Axially loaded					
Compression parallel to grain (F _c)	22.3 (4+ lams) 19.4 (2-3 lams)	22.3 (4+ lams) 19.4 (2-3 lams)	33.0 (4+ lams) 24.4 (2-3 lams)	33.0 (4+ lams) 24.4 (2-3 lams)	0.75
Tension parallel to grain (F _t)	12.5	12.5	20.4	20.4	0.75
Tension perpendicular to grain (F _{tp})	0.51	0.51	0.51	0.51	0.85
Modulus of elasticity (E _{axial})	11,000	11,000	13,100	13,100	0.90
Connections Design					
Mean oven-dry relative density (G)	0.42	0.42	0.42	0.47	–

⁽¹⁾ The combinations in this table are applicable to members consisting of 4 or more laminations, unless otherwise noted.

⁽²⁾ Design of glulam members shall be in accordance with CSA O86, Engineering Design in Wood (Limit States Design).

⁽³⁾ The tabulated design values are for standard-term load duration and dry conditions of use. For other load durations, see applicable design code. For wet conditions of use, multiply the tabulated values by the wet-use factors shown in the rightmost column of the table.

⁽⁴⁾ Specified longitudinal shear has been adjusted to a 2.0 m³ of beam volume.

⁽⁵⁾ The tabulated apparent E values have already included a 5% shear deflection.

⁽⁶⁾ When the member depth is greater than 381 mm (15 inches), the tabulated F_{bx} values shall be multiplied by a factor of 0.88.

⁽⁷⁾ The F_{cp} value is applicable to glulam members made with manufactured lumber. Otherwise, the F_{cp} value shall be 7.0 MPa.

⁽⁸⁾ ES = Eastern spruce.

⁽⁹⁾ In calculating the size factor for bending, K_{zb} , the beam width, b, must be taken as the full member width (mm).

⁽¹⁰⁾ In calculating the factored fracture shear resistance at a notch on the tension side at a support, F_r , the effective lamination width, b_{eff} , must be taken as the beam width (mm).

⁽¹¹⁾ In calculating the size factor for bearing, K_{zcp} , the beam width, b, must be taken as the full member width (mm).

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