

Products: Nordic Lam™
Nordic Structures
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1. Basis of the product report:
 - 2015 National Building Code of Canada (NBCC): Clause 1.2.1.1 of Division A and Clauses 4.1, 4.3.1, 9.23.4.2, and 9.23.10.1 of Division B
 - CSA O86-14 Engineering Design in Wood
 - CSA O122-16 Structural Glued Laminated Timber
 - CSA O177-06 (R2015) Qualification Code for Manufacturers of Structural Glued-Laminated Timber
 - 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 a Black Spruce structural glued laminated timber manufactured in accordance with 20F-E8M1, 20F-ES/CPG, 24F-E/ES1M1, 24F-ES/MSR, 24F-ES/NPG, ES11, ES11/NPG, ES12, and ES12/NPG 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 38 to 327 mm (1-1/2 to 12-7/8 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/data/files/datasheet/file/N-C221BeamsandHeadersJune2013.pdf).

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/data/files/datasheet/file/N-C231ColumnsJune2013.pdf).
4. Product installation:

Nordic Lam™ beams and columns shall be installed in accordance with the recommendations provided by the manufacturer (www.nordic.ca/data/files/datasheet/file/N-C121NordicLamApril2014.pdf) and EWS Technical Note: *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 EWS Technical Note: *Field Notching and Drilling of Glued Laminated Timber Beams*, Form S560 (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 2014 CSA O86 may be considered in designing glulams exposed to fire up to 2 hours when permitted by the authority having jurisdiction.

Nordic Lam™ has been tested in accordance with CAN/ULC S102-10 and meets the flame-spread rating of 26 – 75 and smoke developed classification of 0 – 450.

6. Limitations:
- Nordic Lam™ beams and columns shall be designed in accordance with the code using the engineering properties specified in this report.
 - The dimensions of Nordic Lam™ beams and columns shall follow those specified in Table 1.
 - Nordic Lam™ beams and columns shall be manufactured in accordance with layup combinations specified in APA *Glulam Layup Combinations*, Form Y117 SUP (see link above) or proprietary Nordic Lam™ manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
 - Nordic Lam™ is produced at the Nordic Engineered Wood, Chibougamau, Quebec facilities under a quality assurance program audited by APA.
 - 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, 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	508	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	508	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	20F-ES/CPG	20F-E8M1	24F-E/ES1M1	24F-ES/NPG	24F-ES/MSR	
Bending about X-X Axis (Loaded Perpendicular to Wide Faces of Laminations)						
Bending at extreme fibre due to positive bending moment (F_{bx}^+)	25.6	25.6	30.7	30.7	30.7	0.80
Bending at extreme fibre due to negative bending moment (F_{bx}^-)	25.6	25.6	30.7	30.7	30.7	0.80
Longitudinal shear (F_{vx}) ⁽⁴⁾	2.2	2.2	2.2	2.5	2.2	0.87
Compression perpendicular to grain (F_{cpX})						
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
Bending about Y-Y Axis (Loaded Parallel to Wide Faces of Laminations)						
Bending at extreme fibre due to Positive Bending Moment (F_{by}^+)	25.6	13.4	14.1	30.7	14.1	0.80
Bending at extreme fibre due to Negative Bending Moment (F_{by}^-)	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_{cpY})						
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
Axially Loaded						
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
Connections Design						
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.

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 layout symbol	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}^+)	17.2 ⁽⁶⁾	17.2	24.9 ⁽⁶⁾	30.7	0.80
Bending at extreme fibre due to negative bending moment (F_{bx}^-)	17.2 ⁽⁶⁾	17.2	24.9 ⁽⁶⁾	30.7	0.80
Longitudinal shear (F_{vx}) ⁽⁴⁾	2.2	2.2	2.2	2.5	0.87
Compression perpendicular to grain (F_{cp})					
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.

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