PRODUCT REPORT®

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Nordic X-Lam **PR-L306(C)**
Nordic Structures Revised April 9, 2025

Products: Nordic X-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, 4.3.1.1, and 9.23 of Division B
   - CAN/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
   - FPInnovations Reports 201002775, 201004981, 301010401, 301010956, and 301011903, and other qualification data

2. Product description:
   Nordic X-Lam cross-laminated timber (CLT) is manufactured with Spruce-Pine-Fir (mainly Black Spruce) lumber in accordance with the E1 or custom layups of ANSI/APA PRG 320 through product qualification and/or mathematical models using principles of engineering mechanics. Nordic X-Lam can be used in floor, roof, and wall applications, and is manufactured in a plank billet with nominal widths of 305 to 2,700 mm (12 to 106-1/4 inches), thicknesses of 76 to 381 mm (3 to 15 inches), and lengths up to 19.5 m (64 feet).

3. Design properties:
   Nordic X-Lam CLT shall be designed with the design properties and capacities provided in Tables 1, 2, and 3, or with the maximum load table provided by the manufacturer (www.nordic.ca/en/documentation/technical-documents) using CSA O86. Note that the unbalanced layup listed in Tables 2 and 3, E1/140-4l, shall be stamped with the word “TOP” on the side that contains a single outermost layer in the major strength direction. The design adjustment factors shall be in accordance with CSA O86. The lateral resistance of Nordic X-Lam CLT, when used as shear walls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be designed in accordance with Clause 11.9 of CSA O86, or consulted with the CLT manufacturer and approved by the engineer of record.

4. Product installation:
   Nordic X-Lam CLT shall be installed in accordance with the recommendations provided by the manufacturer (see link above) 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 (see link above). Procedures specified in Annex B of CSA O86 shall be permitted for use in the fire design of Nordic X-Lam CLT when approved by the authority having jurisdiction.

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

6. Limitations:
   a) Nordic X-Lam CLT shall be designed in accordance with principles of mechanics using the design properties specified in this report or provided by the manufacturer.
   b) Nordic X-Lam 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) Design properties for Nordic X-Lam CLT, when used as beams or lintels with loads applied parallel to the face-bond gluelines, other than the edgewise shear properties (see Table 3), are beyond the scope of this report.
   d) Nordic X-Lam CLT shall be manufactured in accordance with layup combinations specified in ANSI/APA PRG 320 or custom Nordic X-Lam CLT manufacturing specifications documented in the in-plant manufacturing standard approved by APA.
   e) Nordic X-Lam CLT is produced at the Nordic Structures, Chibougamau, Quebec facilities under a quality assurance program audited by APA.
   f) This report is subject to re-examination in one year.

7. Identification:
   Nordic X-Lam CLT described in this report is identified by a label bearing the manufacturer's name (Nordic Structures) and/or trademark, the APA assigned plant number (1112), the product standard (ANSI/APA PRG 320), the APA logo, the CLT grade and thickness (or layup ID), the report number PR-L306 or PR-L306C, and a means of identifying the date of manufacture.

Table 1. LSD Specified Strength and Modulus of Elasticity[a] for Lumber Laminations Used in Nordic X-Lam (for Use in Canada)

CLT Grade	Lumber Laminations Used in Major Strength Direction									Lumber Laminations Used in Minor Strength Direction								
	Grade & Species	f_b (MPa)	E (MPa)	f_t (MPa)	f_c (MPa)	f_v (MPa)	f_s (MPa)	f_{cp} (MPa)	G	Grade & Species	f_b (MPa)	E (MPa)	f_t (MPa)	f_c (MPa)	f_v (MPa)	f_s (MPa)	f_{cp} (MPa)	G
E1	1950f-1.7E SPF	28.2	11,700	15.4	19.3	1.5	0.50	5.3	0.42	No. 3 SPF	7.0	9,000	3.2	9.0	1.5	0.50	5.3	0.42

For Imperial: 1 MPa = 145.04 psi

[a] Tabulated values are Limit States design values and not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86. The design values shall be used in conjunction with the section properties provided by the CLT manufacturer based on the actual layup used in manufacturing the CLT panel (see Table 2).

Table 2. LSD Flatwise Bending Stiffness and Unfactored Resistance Values[a,b] for Nordic X-Lam (for Use in Canada)

CLT Grade[c]	Layup ID[d]	Thick-ness, t_p (mm)	Lamination Thickness (mm) in CLT Layup							Major Strength Direction				Minor Strength Direction			
			=	⊥	=	⊥	=	⊥	=	$(f_bS)_{eff,f,0}$ (10^6 N-mm/m)	$(EI)_{eff,f,0}$ (10^9 N-mm²/m)	$(GA)_{eff,f,0}$ (10^6 N/m)	$V_{s\,0}$ (kN/m)	$(f_bS)_{eff,f,90}$ (10^6 N-mm/m)	$(EI)_{eff,f,90}$ (10^9 N-mm²/m)	$(GA)_{eff,f,90}$ (10^6 N/m)	$V_{s,90}$ (kN/m)
E1	78-3s	78	25.8	26.8	25.8					24	452	5.4	26	0.84	14	6.9	8.9
	89-3s	89	35	19.1	35					31	683	7.6	30	0.43	5.2	5.7	6.4
	105-3s	105	35	35	35					42	1,088	7.3	35	1.4	32	9.1	12
	131-5s	131	25.8	26.8	25.8	26.8	25.8			54	1,733	11	44	7.1	363	14	26
	140-4s	140	35	2 x 35	35					69	2,350	8.5	47	5.7	257	18	23
	140-4l[e]	140	2 x 35	35	35					67	2,473	11	47	1.4	32	9.8	12
	143-5s	143	35	19.1	35	19.1	35			72	2,531	15	48	5.6	263	11	24
	175-5s	175	35	35	35	35	35			98	4,166	15	58	12	837	18	35
	197-7s	197	35	19.1	35	19.1	35	19.1	35	129	6,194	23	66	13	1,045	17	42
	213-7l	213	2 x 35	19.1	35	19.1	2 x 35			175	9,117	25	71	5.6	263	14	24
	220-7s	220	35	26.8	35	26.8	35	26.8	35	150	8,050	22	73	20	1,915	22	50
	245-7s	245	35	35	35	35	35	35	35	172	10,306	22	82	29	3,220	27	58
	245-7l	245	2 x 35	35	35	35	2 x 35			222	13,279	22	82	12	837	20	35
	267-9l	267	2 x 35	19.1	35	19.1	35	19.1	2 x 35	266	17,327	32	89	13	1,045	19	42
	315-9l	315	2 x 35	35	35	35	35	35	2 x 35	344	26,442	29	105	29	3,220	29	58

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 (LSD) design values and not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86.

[b] Deflection under a specified uniformly distributed load, w, acting perpendicular to the face of a single-span CLT 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;
L = span, m;
w = uniform load, N/m²;
$(EI)_{eff}$ = tabulated effective bending stiffness, 10^9 N-mm²/m; and

$(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10^6 N/m.

For a concentrated line load, P, located in the middle of a single span CLT 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;
L = span, m;
$(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10^6 N/m.
P = concentrated load, N/m of width;
$(EI)_{eff}$ = tabulated effective bending stiffness, 10^9 N-mm^2/m; and

(c) The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.
(d) The layup designation refers to the panel thickness (in mm), the number of layers, and the layup combination ("s" for standard perpendicular layers, and "l" for doubled outermost parallel layers).
(e) This layup is not balanced (the top and bottom layers are different in the layer thickness). The side that contains a single outermost layer in the major strength direction must be stamped with the word "TOP".

Table 3. LSD Specified Edgewise Shear Strength and Rigidity for Nordic X-Lam (for Use in Canada)

CLT Grade	Layup ID	Thickness, t_p (mm)	Major Strength Direction		Minor Strength Direction	
			$f_{v,e,0}$[a] (MPa)	$G_{e,0}\,t_p$[d] (10^6 N/m)	$f_{v,e,90}$[a] (MPa)	$G_{e,90}\,t_p$[d] (10^6 N/m)
E1	78-3s	78	2.0[b]	20	2.4[b]	20
	89-3s	89	2.0	22	2.4[b]	22
	105-3s	105	2.0	26	2.4	26
	131-5s	131	2.4[c]	33	2.7[c]	33
	140-4s	140	1.8	35	2.4[b]	35
	140-4l	140	2.0[b]	35	2.4[b]	35
	143-5s	143	2.4[c]	36	2.7[c]	36
	175-5s	175	2.4	44	2.7	44
	197-7s	197	2.0[b]	49	2.7[c]	49
	213-7l	213	2.4[c]	53	2.7[c]	53
	220-7s	220	2.4[c]	55	2.7[c]	55
	245-7s	245	2.4[c]	61	2.7[c]	61
	245-7l	245	2.4[c]	61	2.7[c]	61
	267-9l	267	2.0[b]	67	2.7[c]	67
	315-9l	315	2.4[c]	79	2.7[c]	79

For Imperial: 1 MPa = 145.04 psi

[a] The tabulated values are LSD design values for use in Canada based on the full CLT thickness in the major strength direction ($f_{v,e,0}$) and minor strength direction ($f_{v,e,90}$). The values shall be used in conjunction with the CLT thickness, t_p, to determine the in-plane shear capacities. If the net CLT thickness is less than the full CLT thickness, the in-plane shear capacities shall be calculated based on the net CLT thickness.

[b] Based on test results from 105-3s.

[c] Based on test results from 175-5s.

[d] Edgewise shear rigidity is based on $G_{e,0}$ and $G_{e,90}$ values of 250 MPa and the CLT thickness, t_p, in accordance with product performance testing.

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