

**Nordic X-Lam**  
**Nordic Structures**

**PR-L306C**  
Revised April 9, 2019

Products: Nordic X-Lam

Nordic Structures, 1100 Avenue des Canadiens-de-Montréal, Suite 100, Montreal, Québec,  
Canada H3B 2S2

(514) 871-8526

[www.nordic.ca](http://www.nordic.ca)

1. Basis of the product report:
  - 2015 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 O86-14 (reprint 2016) Engineering Design in Wood
  - ANSI/APA PRG 320-2017 Performance Rated Cross-Laminated Timber
  - 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 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 2438 mm (12 to 96 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](http://www.nordic.ca/en/documentation/technical-documents)). The design adjustment factors, shall be based on CSA O86, the recommendations provided by the manufacturer, or the 2011 Canadian CLT Handbook ([www.fpinnovations.ca/Pages/CltForm.aspx](http://www.fpinnovations.ca/Pages/CltForm.aspx)), and approved by the engineer of record. The lateral resistance of Nordic X-Lam CLT, when used as shearwalls or diaphragms, depends on the panel-to-panel connection and anchorage designs, and shall be 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 or Chapter 8 of the 2011 Canadian CLT Handbook (see link above) may be used 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 S102-10, 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 percent or less and does not exceed 19 percent.
  - 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 proprietary 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 layup (E1), the report number PR-L306, and a means of identifying the date of manufacture.

Table 1. LSD Specified Strengths and Modulus of Elasticity<sup>(a)</sup> for Lumber Laminations Used in Nordic X-Lam (For Use in Canada)

CLT Layup	Lumber Laminations Used in Major Strength Direction							Lumber Laminations Used in Minor Strength Direction						
	f <sub>b</sub> (MPa)	E (MPa)	f <sub>t</sub> (MPa)	f <sub>c</sub> (MPa)	f <sub>c,L</sub> (MPa)	f <sub>v</sub> (MPa)	f <sub>s</sub> (MPa)	f <sub>b</sub> (MPa)	E (MPa)	f <sub>t</sub> (MPa)	f <sub>c</sub> (MPa)	f <sub>c,L</sub> (MPa)	f <sub>v</sub> (MPa)	f <sub>s</sub> (MPa)
E1	28.2	11,700	15.4	19.3	5.3	1.5	0.5	7.0	9,000	3.2	9.0	5.3	1.5	0.5

For Imperial: 1 MPa = 145.04 psi

<sup>(a)</sup> 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<sup>(a)</sup> for Nordic X-Lam (For Use in Canada)

CLT Layup <sup>(b)</sup>	Layup ID <sup>(c)</sup>	Thick-ness, t <sub>p</sub> (mm)	Lamination Thickness (mm) in CLT Layup						Major Strength Direction				Minor Strength Direction				
			=	⊥	=	⊥	=	⊥	=	(f <sub>b</sub> S) <sub>eff,f,0</sub> (10 <sup>6</sup> N-mm/m)	(EI) <sub>eff,f,0</sub> (10 <sup>9</sup> N-mm <sup>2</sup> /m)	(GA) <sub>eff,f,0</sub> (10 <sup>6</sup> N/m)	V <sub>s,0</sub> (kN/m)	(f <sub>b</sub> S) <sub>eff,f,90</sub> (10 <sup>6</sup> N-mm/m)	(EI) <sub>eff,f,90</sub> (10 <sup>9</sup> N-mm <sup>2</sup> /m)	(GA) <sub>eff,f,90</sub> (10 <sup>6</sup> N/m)	V <sub>s,90</sub> (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	34.9	19.1	34.9					31	678	7.5	30	0.42	5.2	5.7	6.3
	105-3s	105	34.9	34.9	34.9					42	1,081	7.3	35	1.40	32	9.0	12
	131-5s	131	25.8	26.8	25.8	26.8	25.8			54	1,735	11	44	7.1	364	14	26
	140-4s	140	34.9	2 x 34.9	34.9					68	2,334	8.5	47	5.7	256	18	23
	143-5s	143	34.9	19.1	34.9	19.1	34.9			72	2,514	15	48	5.6	261	11	24
	175-5s	175	34.9	34.9	34.9	34.9	34.9			97	4,140	15	58	12	832	18	35
	197-7s	197	34.9	19.1	34.9	19.1	34.9	19.1	34.9	128	6,152	23	66	13	1,037	17	42
	213-7l	213	2 x 34.9	19.1	34.9	19.1	2 x 34.9			174	9,056	25	71	5.6	261	14	24
	220-7s	220	34.9	26.8	34.9	26.8	34.9	26.8	34.9	149	8,019	22	73	20	1,913	22	50
	244-7s	244	34.9	34.9	34.9	34.9	34.9	34.9	34.9	172	10,240	22	81	28	3,199	27	58
	244-7l	244	2 x 34.9	34.9	34.9	34.9	2 x 34.9			221	13,194	22	81	12	832	20	35
	267-9l	267	2 x 34.9	19.1	34.9	19.1	34.9	19.1	2 x 34.9	264	17,211	32	89	13	1,037	19	42
	314-9l	314	2 x 34.9	34.9	34.9	34.9	34.9	34.9	2 x 34.9	342	26,272	29	105	28	3,199	29	58

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

<sup>(a)</sup> 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.

<sup>(b)</sup> The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

<sup>(c)</sup> 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).

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

CLT Layup	Layup ID	Thickness, $t_p$ (mm)	Major Strength Direction		Minor Strength Direction	
			$f_{v,e,0}$ <sup>(a)</sup> (MPa)	$G_{e,0} t_p$ <sup>(d)</sup> (10 <sup>6</sup> N/m)	$f_{v,e,90}$ <sup>(a)</sup> (MPa)	$G_{e,90} t_p$ <sup>(d)</sup> (10 <sup>6</sup> N/m)
E1	78-3s	78	2.0 <sup>(b)</sup>	20	2.4 <sup>(b)</sup>	20
	89-3s	89	2.0	22	2.4 <sup>(b)</sup>	22
	105-3s	105	2.0	26	2.4	26
	131-5s	131	2.4 <sup>(c)</sup>	33	2.7 <sup>(c)</sup>	33
	140-4s	140	1.8	35	2.4 <sup>(b)</sup>	35
	143-5s	143	2.4 <sup>(c)</sup>	36	2.7 <sup>(c)</sup>	36
	175-5s	175	2.4	44	2.7	44
	197-7s	197	2.0 <sup>(b)</sup>	49	2.7 <sup>(c)</sup>	49
	213-7l	213	2.4 <sup>(c)</sup>	53	2.7 <sup>(c)</sup>	53
	220-7s	220	2.4 <sup>(c)</sup>	55	2.7 <sup>(c)</sup>	55
	244-7s	244	2.4 <sup>(c)</sup>	61	2.7 <sup>(c)</sup>	61
	244-7l	244	2.4 <sup>(c)</sup>	61	2.7 <sup>(c)</sup>	61
	267-9l	267	2.0 <sup>(b)</sup>	67	2.7 <sup>(c)</sup>	67
	314-9l	314	2.4 <sup>(c)</sup>	79	2.7 <sup>(c)</sup>	79

For Imperial: 1 MPa = 145.04 psi

- (a) The tabulated values are for Limit States Design (LSD) 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  $G_{e,90} = 250$  MPa and the CLT thickness,  $t_p$ , in accordance with product performance testing.

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**APA – THE ENGINEERED WOOD ASSOCIATION  
 HEADQUARTERS**

7011 So. 19<sup>th</sup> St. • Tacoma, Washington 98466  
 Phone: (253) 565-6600 • Fax: (253) 565-7265 • Internet Address: [www.apawood.org](http://www.apawood.org)

**PRODUCT SUPPORT HELP DESK**  
 (253) 620-7400 • E-mail Address: [help@apawood.org](mailto:help@apawood.org)

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