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Nordic X-Lam Industrial CLT Matting
Nordic Structures

PR-L331C
Issued December 11, 2020

Products: Nordic X-Lam Industrial CLT Matting
Nordic Structures, 1100 Avenue des Canadiens-de-Montréal, Suite 100, Montreal, Québec H3B 2S2, Canada
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1. Basis of the product report:
   - ANSI/APA PRG 320-2019 Standard for Performance-Rated Cross-Laminated Timber
   - APA Custom Product Specification L-375, Industrial CLT Matting

2. Product description:
   Nordic X-Lam industrial cross-laminated timber (CLT) matting is manufactured with Spruce-Pine-Fir (mainly Black Spruce) lumber in accordance with the IND-331 and custom grades of ANSI/APA PRG 320 through product qualification and/or mathematical models using principles of engineering mechanics. Nordic X-Lam industrial CLT matting shall be limited to industrial applications and are not intended for use in timber structures or similar constructions, except for spanning over a short opening (up to 18 times the CLT thickness) recommended by the manufacturer. Nordic X-Lam industrial CLT matting 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 industrial CLT matting shall be designed with the design properties and capacities provided in Tables 1, 2, and 3, when used in different moisture conditions, or with the recommendations provided by the manufacturer (www.nordic.ca). The design adjustment factors shall be based on CSA O86 and the recommendations provided by the manufacturer.

4. Product installation:
   Nordic X-Lam industrial CLT matting shall be installed in accordance with the recommendations provided by the manufacturer (see link above).

5. Limitations:
   a) Nordic X-Lam industrial CLT matting 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 industrial CLT matting shall be limited to industrial applications and are not intended for use in timber structures or similar constructions, except for spanning over a short opening (up to 18 times the CLT thickness) recommended by the manufacturer.
   c) Nordic X-Lam industrial CLT matting shall be manufactured in accordance with custom Nordic X-Lam industrial CLT matting specification IND-331 documented in the in-plant manufacturing standard approved by APA.
   d) The design values recognized in this report are limited to new products. The effect of re-use on the design values is beyond the scope of this report.
   e) Nordic X-Lam industrial CLT matting 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.

6. Identification:
Nordic X-Lam industrial CLT matting 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 APA Custom Product Specification (L-375), the APA logo, the industrial CLT matting grade (IND-331), the report number PR-L331, and a means of identifying the date of manufacture.

Table 1. LSD Specified Strength and Modulus of Elasticity[a,b] for Lumber Laminations Used in Nordic X-Lam industrial CLT Matting (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)	$f_{c\perp}$ (MPa)	f_v (MPa)	f_s (MPa)	Grade & Species	f_b (MPa)	E (MPa)	f_t (MPa)	f_c (MPa)	$f_{c\perp}$ (MPa)	f_v (MPa)	f_s (MPa)
E1	1950f-1.7E SPF	28.2	11,700	15.4	19.3	5.3	1.5	0.50	No. 3 SPF	7.0	9,000	3.2	9.0	5.3	1.5	0.50
Wet-use factor	NA	0.84	0.94	0.84	0.69	0.67	0.96	0.96	NA	0.84	0.94	0.84	0.69	0.67	0.96	0.96

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 industrial CLT matting manufacturer based on the actual layup used in manufacturing the industrial CLT matting panel (see Tables 2 and 3).

(b) The tabulated Limit States design values are for dry conditions of use where the average equilibrium moisture content of solid-sawn lumber over a year is 15 percent or less and does not exceed 19 percent. For wet conditions of use, i.e. all service conditions other than dry, multiply the tabulated values by the wet-use factors shown at the bottom of the table.

Table 2. LSD Flatwise Bending Stiffness and Unfactored Resistance Values[a] for Nordic X-Lam Industrial CLT Matting Listed in Table 1 (**Dry Conditions**)
(For Use in Canada)

CLT Grade[b]	Layup ID[c]	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)
IND-331	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[d]	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 values and not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86. The tabulated unfactored Limit States design values are for dry conditions of use where the average equilibrium moisture content of solid-sawn lumber over a year is 15 percent or less and does not exceed 19 percent.

[b] The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

[c] The layup designation refers to the panel thickness (expressed in mm), the number of layers, and the layup combination ("s" for standard perpendicular layers, and "l" for doubled outermost parallel layers).

[d] This layup is not balanced (the top and bottom layers are different in the layer thickness), which shall be considered in design and installation based on the manufacturer's recommendations.

Table 3. LSD Flatwise Bending Stiffness and Unfactored Resistance Values[a] for Nordic X-Lam Industrial CLT Matting Listed in Table 1 (**Wet Conditions**) (For Use in Canada)

CLT Grade[b]	Layup ID[c]	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)
IND-331	78-3s	78	25.8	26.8	25.8					20	424	5.1	25	0.70	14	6.5	8.6
	89-3s	89	35	19.1	35					26	642	7.1	29	0.36	4.9	5.4	6.1
	105-3s	105	35	35	35					36	1,023	6.9	34	1.20	30	8.5	11
	131-5s	131	25.8	26.8	25.8	26.8	25.8			46	1,629	10	42	6.0	341	13	25
	140-4s	140	35	2 x 35	35					58	2,209	8.0	45	4.80	242	17	22
	140-4l[d]	140	2 x 35	35	35					56	2,325	10	45	1.20	30	9.2	11
	143-5s	143	35	19.1	35	19.1	35			61	2,379	14	46	4.7	248	11	23
	175-5s	175	35	35	35	35	35			82	3,916	14	56	10	787	17	34
	197-7s	197	35	19.1	35	19.1	35	19.1	35	108	5,822	21	63	11	982	16	41
	213-7l	213	2 x 35	19.1	35	19.1	2 x 35			147	8,570	23	68	4.7	248	13	23
	220-7s	220	35	26.8	35	26.8	35	26.8	35	126	7,567	21	71	17	1,800	20	48
	245-7s	245	35	35	35	35	35	35	35	145	9,688	21	78	24	3,027	26	56
	245-7l	245	2 x 35	35	35	35	2 x 35			187	12,483	21	78	10	787	18	34
	267-9l	267	2 x 35	19.1	35	19.1	35	19.1	2 x 35	223	16,287	30	86	11	982	18	41
	315-9l	315	2 x 35	35	35	35	35	35	2 x 35	289	24,856	27	101	24	3,027	27	56

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 values and not permitted to be increased for the lumber size adjustment factor in accordance with CSA O86. The tabulated unfactored Limit States design values are for wet conditions of use.

[b] The CLT layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

[c] The layup designation refers to the panel thickness (expressed in mm), the number of layers, and the layup combination ("s" for standard perpendicular layers, and "l" for doubled outermost parallel layers).

[d] This layup is not balanced (the top and bottom layers are different in the layer thickness), which shall be considered in design and installation based on the manufacturer's recommendations.

APA – The Engineered Wood Association is an approved national standards developer accredited by American National Standards Institute (ANSI). APA publishes ANSI standards and Voluntary Product Standards for wood structural panels and engineered wood products. APA is an accredited certification body under ISO/IEC 17065 by Standards Council of Canada (SCC), an accredited inspection agency under ISO/IEC 17020 by International Code Council (ICC) International Accreditation Service (IAS), and an accredited testing organization under ISO/IEC 17025 by IAS. APA is also an approved Product Certification Agency, Testing Laboratory, Quality Assurance Entity, and Validation Entity by the State of Florida, and an approved testing laboratory by City of Los Angeles.

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