PRODUCT REPORT
CANADA
www.apawood.org

Kalesnikoff Cross-Laminated Timber
Kalesnikoff Mass Timber Inc.

PR-L332(C)
Revised November 23, 2023

Products: Kalesnikoff Cross-Laminated Timber
Kalesnikoff Mass Timber Inc., PO Box 3000 BC-3A, Castlegar, British Columbia, Canada V1N 4N1
(250) 399-4211
www.kalesnikoff.com

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
   - APA Reports T2020P-35, T2020P-40, T2020P-48, T2020P-50, T2021P-20, and T2021P-31, and other qualification data

2. Product description:
   Kalesnikoff cross-laminated timber (CLT) is manufactured with laminating lumber in accordance with ANSI/APA PRG 320 or custom layup combinations approved by APA through product qualification and/or mathematical models using principles of engineering mechanics. The laminating lumber shall have Limit States design (LSD) specified strength and modulus of elasticity provided in Table 1. The SPF laminations listed in Table 1 shall be permitted to be substituted by Douglas fir-Larch or Hem-fir lumber with design properties that are equal to or greater than the corresponding SPF laminations. When Hem-fir is used to substitute SPF in the outermost layers of the CLT layup, the bearing capacity of the CLT should be based on the specified compressive strength perpendicular to grain (f_{cp}) of 4.6 MPa. Kalesnikoff CLT can be used in floor, roof, and wall applications, and is manufactured with nominal widths up to 3,505 mm (138 inches), thicknesses of 87 to 342 mm (3.4 to 13.5 inches), and lengths up to 18.3 m (60 feet).

3. Design properties:
   Kalesnikoff CLT shall be designed with the design properties and capacities provided in Tables 2 and 3. Note that the unbalanced layup listed in Tables 2 and 3, V2/8-ply EL, shall be stamped with the word “TOP” on the side that contains a single outermost layer in the major strength direction. The design value adjustment factors shall be in accordance with CSA O86. The lateral resistance of Kalesnikoff 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:
   Kalesnikoff CLT shall be installed in accordance with the recommendations provided by the manufacturer (www.kalesnikoff.com) 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 Kalesnikoff CLT when approved by the authority having jurisdiction.

6. Limitations:
   a) Kalesnikoff CLT shall be designed in accordance with principles of mechanics using the design properties specified in this report or provided by the manufacturer.
   b) Kalesnikoff CLT 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 Kalesnikoff 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) Kalesnikoff CLT shall be manufactured in compliance with ANSI/APA PRG 320 and documented in the Kalesnikoff Mass Timber Inc.'s in-plant manufacturing standard approved by APA.
   e) Kalesnikoff CLT is produced at the Kalesnikoff, South Slocan, British Columbia facility under a quality assurance program audited by APA.
   f) This report is subject to re-examination in one year.

7. Identification:
   Kalesnikoff CLT described in this report is identified by a label bearing the manufacturer's name (Kalesnikoff) and/or trademark, the APA assigned plant number (1133), the product standard (ANSI/APA PRG 320), the APA logo, the CLT grade and thickness (or layup ID), the report number PR-L332 or PR-L332C, and a means of identifying the date of manufacture.

Table 1. LSD Specified Strengths and Modulus of Elasticity[(a)] for Lumber Laminations Used in Kalesnikoff CLT (for Use in Canada)

CLT Grade	Laminations Used in Major Strength Direction									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, E1.1, E1.2, & E1.3	1950f-1.7E SPF[(b)]	28.2	11,700	15.4	19.3	1.5	0.50	5.3	0.42	No. 3 SPF[(b)]	7.0	9,000	3.2	9.0	1.5	0.50	5.3	0.42
E1M8	1950f-1.7E SPF[(b)]	28.2	11,700	15.4	19.3	1.5	0.50	5.3	0.42	1950f-1.7E SPF[(b)]	28.2	11,700	15.4	19.3	1.5	0.50	5.3	0.42
E1M9	1950f-1.7E SPF[(b)]	28.2	11,700	15.4	19.3	1.5	0.50	5.3	0.42	No. 1/No. 2 SPF[(b)]	11.8	9,500	5.5	11.5	1.5	0.50	5.3	0.42
E1M11	1650f-1.5E SPF	23.9	10,300	11.4	18.1	1.5	0.50	5.3	0.42	No. 3 SPF[(b)]	7.0	9,000	3.2	9.0	1.5	0.50	5.3	0.42
E1M13	1650f-1.5E SPF	23.9	10,300	11.4	18.1	1.5	0.50	5.3	0.42	No. 1/No. 2 SPF[(b)]	11.8	9,500	5.5	11.5	1.5	0.50	5.3	0.42
V2, V2.2, & V2.4	No. 1/No. 2 SPF[(b)]	11.8	9,500	5.5	11.5	1.5	0.50	5.3	0.42	No. 3 SPF[(b)]	7.0	9,000	3.2	9.0	1.5	0.50	5.3	0.42
V2M6	No. 1/No. 2 SPF[(b)]	11.8	9,500	5.5	11.5	1.5	0.50	5.3	0.42	No. 1/No. 2 SPF[(b)]	11.8	9,500	5.5	11.5	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).

(b) The SPF laminations shall be permitted to be substituted by Douglas fir-Larch or Hem-fir lumber of equal or greater design properties. When Hem-fir is used to substitute SPF in the CLT layup, the bearing capacity of the CLT should be based on the specified compressive strength perpendicular to grain (f_{cp}) of 4.6 MPa.

Table 2. LSD Stiffness and Unfactored Resistance Values[(a,b)] for Kalesnikoff CLT (for Use in Canada)

CLT Grade[(c)]	Layup ID	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	3-ply	105	35	35	35							42	1,088	7.3	35	1.4	32	9.1	12
	5-ply	175	35	35	35	35	35					98	4,166	15	58	12	837	18	35
	7-ply	245	35	35	35	35	35	35	35			172	10,306	22	82	29	3,220	27	58
	9-ply	315	35	35	35	35	35	35	35	35	35	267	20,536	29	105	51	7,984	36	82
E1.1	3-ply	93	38	17	38							34	780	8.5	31	0.34	3.7	5.5	6
	5-ply	148	38	17	38	17	38					79	2,858	17	49	5.2	241	11	24
	7-ply	203	38	17	38	17	38	17	38			141	6,970	26	68	12	963	17	42
	9-ply	258	38	17	38	17	38	17	38	17	38	219	13,794	34	86	21	2,424	22	61
E1.2	3-ply	114	38	38	38							50	1,392	7.9	38	1.7	41	9.8	13
	5-ply	190	38	38	38	38	38					115	5,332	16	63	15	1,072	20	38
	7-ply	266	38	38	38	38	38	38	38			203	13,190	24	89	34	4,121	30	63
	9-ply	342	38	38	38	38	38	38	38	38	38	315	26,282	32	114	60	10,218	39	89

Table 2. LSD Stiffness and Unfactored Resistance Values[(a,b)] for Kalesnikoff CLT (for Use in Canada) (Continued)

CLT Grade[(c)]	Layup ID	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-mm^2/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-mm^2/m)	$(GA)_{eff,f,90}$ (10^6 N/m)	$V_{s,90}$ (kN/m)
E1.3	3-ply	87	35	17	35							30	637	7.7	29	0.34	3.7	5.3	6
	5-ply	139	35	17	35	17	35					69	2,347	15	46	4.9	216	11	23
	7-ply	191	35	17	35	17	35	17	35			123	5,732	23	64	11	860	16	40
	9-ply	243	35	17	35	17	35	17	35	17	35	191	11,351	31	81	19	2,161	21	58
E1M8	3-ply	105	35	35	35							42	1,088	9.3	35	5.8	42	9.3	12
	5-ply	175	35	35	35	35	35					98	4,175	19	58	50	1,088	19	35
	7-ply	245	35	35	35	35	35	35	35			173	10,338	28	82	115	4,175	28	58
	9-ply	315	35	35	35	35	35	35	35	35	35	268	20,615	37	105	203	10,338	37	82
E1M9	3-ply	105	35	35	35							42	1,088	7.7	35	2.4	34	9.1	12
	5-ply	175	35	35	35	35	35					98	4,168	15	58	21	884	18	35
	7-ply	245	35	35	35	35	35	35	35			172	10,312	23	82	48	3,397	27	58
	9-ply	315	35	35	35	35	35	35	35	35	35	267	20,551	31	105	85	8,420	36	82
E1M11	3-ply	105	35	35	35							36	958	7.2	35	1.4	32	8.1	12
	5-ply	175	35	35	35	35	35					83	3,671	14	58	12	837	16	35
	7-ply	245	35	35	35	35	35	35	35			146	9,086	22	82	29	3,215	24	58
	9-ply	315	35	35	35	35	35	35	35	35	35	227	18,110	29	105	51	7,968	32	82
E1M13	3-ply	105	35	35	35							36	958	7.6	35	2.4	34	8.1	12
	5-ply	175	35	35	35	35	35					83	3,673	15	58	21	884	16	35
	7-ply	245	35	35	35	35	35	35	35			146	9,091	23	82	48	3,392	24	58
	9-ply	315	35	35	35	35	35	35	35	35	35	227	18,125	30	105	85	8,403	33	82
V2	3-ply	105	35	35	35							18	884	7.2	35	1.4	32	7.5	12
	5-ply	175	35	35	35	35	35					41	3,388	14	58	12	837	15	35
	5-ply EL	175	35 x 2	35	35 x 2							51	4,210	15	58	1.4	32	8.9	12
	7-ply	245	35	35	35	35	35	35	35			72	8,388	22	82	29	3,213	23	58
	7-ply EL	245	35 x 2	35	35	35	35 x 2					93	10,788	22	82	12	837	16	35
	8-ply EL[(d)]	280	35 x 2	35	35	35	35	35	35			96	13,660	25	93	29	3,213	23	58
	9-ply	315	35	35	35	35	35	35	35	35	35	112	16,724	29	105	51	7,958	30	82
	9-ply EL	315	35 x 2	35	35	35	35	35	35 x 2			144	21,490	29	105	29	3,213	24	58

Table 2. LSD Stiffness and Unfactored Resistance Values[a,b] for Kalesnikoff CLT (for Use in Canada) (Continued)

CLT Grade[c]	Layup ID	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)
V2.2	3-ply	87	35	17	35							13	518	7.5	29	0.34	3.7	4.4	6
	5-ply	139	35	17	35	17	35					29	1,907	15	46	4.9	215	8.7	23
	5-ply EL	157	35 x 2	17	35 x 2							41	3,060	18	52	0.34	3.7	6.3	6
	7-ply	191	35	17	35	17	35	17	35			52	4,659	22	64	11	856	13	40
	7-ply EL	209	35 x 2	17	35	17	35 x 2					71	7,008	25	70	4.9	215	11	23
	9-ply	243	35	17	35	17	35	17	35	17	35	80	9,230	30	81	19	2,147	17	58
	9-ply EL	261	35 x 2	17	35	17	35	17	35 x 2			107	13,218	32	87	11	856	15	40
V2.4	3-ply	114	38	38	38							21	1,131	7.8	38	1.7	41	8.2	13
	5-ply	190	38	38	38	38	38					48	4,336	16	63	15	1,071	16	38
	7-ply	266	38	38	38	38	38	38	38			85	10,735	23	89	34	4,112	24	63
	9-ply	342	38	38	38	38	38	38	38	38	38	132	21,403	31	114	60	10,185	33	89
V2M6	3-ply	105	35	35	35							18	884	7.6	35	2.4	34	7.6	12
	5-ply	175	35	35	35	35	35					41	3,390	15	58	21	884	15	35
	7-ply	245	35	35	35	35	35	35	35			72	8,394	23	82	48	3,390	23	58
	9-ply	315	35	35	35	35	35	35	35	35	35	112	16,738	30	105	85	8,394	30	82

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.

(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;
$(GA)_{eff}$ = tabulated effective in-plane (planar) shear rigidity, 10^6 N/m.
w = uniform load, N/m²;
$(EI)_{eff}$ = tabulated effective bending stiffness, 10^9 N-mm²/m; and

For a concentrated 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-mm²/m; and

(c) The CLT grade and layups are developed based on ANSI/APA PRG 320, as permitted by the standard.

(d) 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 In-Plane Shear Strength and In-Plane Shear Capacity[(a)] for Kalesnikoff CLT (for Use in Canada)

CLT Grade	Layup ID	Thickness, t_p (mm)	Specified In-Plane Shear Strength	
			$f_{v,e,0}$ (MPa)	$f_{v,e,90}$ (MPa)
E1	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
E1.1	3-ply	93	1.3[(b)]	1.3[(b)]
	5-ply	148	2.1[(c)]	2.1[(c)]
	7-ply	203	2.1[(c)]	2.1[(c)]
	9-ply	258	2.1[(c)]	2.1[(c)]
E1.2	3-ply	114	1.3[(b)]	1.3[(b)]
	5-ply	190	2.1[(c)]	2.1[(c)]
	7-ply	266	2.1[(c)]	2.1[(c)]
	9-ply	342	2.1[(c)]	2.1[(c)]
E1.3	3-ply	87	1.3[(b)]	1.3[(b)]
	5-ply	139	2.1[(c)]	2.1[(c)]
	7-ply	191	2.1[(c)]	2.1[(c)]
	9-ply	243	2.1[(c)]	2.1[(c)]
E1M8	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
E1M9	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
E1M11	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
E1M13	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
V2	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	5-ply EL	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	7-ply EL	245	2.1[(c)]	2.1[(c)]
	8-ply EL[(d)]	280	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]
	9-ply EL	315	2.1[(c)]	2.1[(c)]
V2.2	3-ply	87	1.3	1.3[(b)]
	5-ply	139	2.1	2.1[(c)]
	5-ply EL	157	2.1[(c)]	2.1[(c)]
	7-ply	191	2.1[(c)]	2.1[(c)]
	7-ply EL	209	2.1[(c)]	2.1[(c)]
	9-ply	243	2.1[(c)]	2.1[(c)]
	9-ply EL	261	2.1[(c)]	2.1[(c)]
V2.4	3-ply	114	1.3[(b)]	1.3[(b)]
	5-ply	190	2.1[(c)]	2.1[(c)]
	7-ply	266	2.1[(c)]	2.1[(c)]
	9-ply	342	2.1[(c)]	2.1[(c)]

Table 3. LSD Specified In-Plane Shear Strength and In-Plane Shear Capacity[(a)] for Kalesnikoff CLT (for Use in Canada) (Continued)

CLT Grade	Layup ID	Thickness, t_p (mm)	Specified In-Plane Shear Strength	
			$f_{v,e,0}$ (MPa)	$f_{v,e,90}$ (MPa)
V2M6	3-ply	105	1.3[(b)]	1.3[(b)]
	5-ply	175	2.1[(c)]	2.1[(c)]
	7-ply	245	2.1[(c)]	2.1[(c)]
	9-ply	315	2.1[(c)]	2.1[(c)]

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 3-ply of V2.2.

(c) Based on test results from 5-ply of V2.2.

(d) 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."

APA – THE ENGINEERED WOOD ASSOCIATION

HEADQUARTERS

7011 So. 19th St. ▪ Tacoma, Washington 98466

Phone: (253) 565-6600 ▪ Fax: (253) 565-7265 ▪ Internet Address: www.apawood.org

PRODUCT SUPPORT HELP DESK

(253) 620-7400 ▪ *E-mail Address*: help@apawood.org