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DIVISION: 06 00 00 – WOOD, PLASTICS, AND COMPOSITES
Section: 06 17 19 – Cross-laminated Timber

REPORT HOLDER:
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REPORT SUBJECT:
KLH Massivholzplatten CLT

1.0 SCOPE OF EVALUATION

1.1 This Research Report addresses compliance with the following Codes:

- 2024, 2021 and 2018 *International Building Code*® (IBC)
- 2024, 2021 and 2018 *International Residential Code*® (IRC)
- 2025 and 2022 *California Building Code* (see Section 9)
- 2023 *Florida Building Code* Including High-Velocity Hurricane Zones (see Section 9)

NOTE: This report references the most recent Code editions noted. Section numbers in earlier editions may differ.

1.2 KLH Massivholzplatten CLT has been evaluated for the following properties (see Table 1):

- Structural properties
- Surface-burning characteristics
- Fire resistance

1.3 KLH Massivholzplatten CLT has been evaluated for the following uses (see Table 1):

- Use as components in roofs and floors in Types I and II construction
- Use as interior walls, roofs, and floors in Type III construction
- Use as walls, roofs, and floors in Type IV construction (See Section 6)
- Use as walls, roofs, and floors in Type V construction

2.0 STATEMENT OF COMPLIANCE

KLH Massivholzplatten CLT complies with the Codes listed in Section 1.1, for the properties stated in Section 1.2 and uses stated in Section 1.3, when installed as described in this report, including the Conditions of Use stated in Section 6.

2.1 2024 IBC and IRC Evaluation Reports

The Intertek CCRR is an *Evaluation Report* for approval of an alternate material, design, or method of construction in accordance with Section 104.2.3.6.1 of the 2024 IBC and Section R104.2.2.6.1 of the 2024 IRC.

3.0 DESCRIPTION

3.1 General: KLH Massivholzplatten (solid wood slabs) cross laminated timber (CLT) is a wood structural building element for walls, floors (ceilings) and roofs. The CLT panels consist of 3 to 8 layers stacked crosswise (layers at 90°) and glued on their wide faces. Some panel layouts include two adjacent surface layers and/or two adjacent central layers that are arranged parallel to each other. Refer to Tables 3 through 6 for available panel layouts.

The CLT panels are offered in a maximum length of 54 ft 2 in. (16.5 m); standard widths of 7 ft 5 in. (2.27m), 7 ft 10 in. (2.40m), 8 ft 2 in. (2.50m), 8 ft 11 in. (2.73m), 9 ft 8 in. (2.95 m) and 11 ft 5 in. (3.5m); and a maximum thickness of 1 ft 1/2 in. (0.32 m).

3.2 Wood laminations: KLH Massivholzplatten CLT is comprised of laminations of Austrian Spruce having the reference design values listed in Table 2.

3.3 Adhesives: Adhesives used to face-bond layers of KLH Massivholzplatten CLT and for finger-joints of the lamella are one-component formaldehyde-free PUR adhesives conforming to ANSI/APA PRG 320-2019.



4.0 PERFORMANCE CHARACTERISTICS

4.1 Reference Design Values: Tables 7 through 10 of this Report contain reference design values for bending, shear, and compression capacities of the CLT panels. Table 11 contains reference design values for in-plane shear of the CLT panels. The reference design values in Tables 7 through 11 are intended for use in Allowable Stress Design (ASD) and must be adjusted as indicated in Section 4.2. For use in Load and Resistance Factor Design (LRFD), the ASD values shall be multiplied by the appropriate factors specified in Table 10.3.1 of the AWC NDS.

4.2 Adjustment Factors: The reference design values specified in Tables 7 through 11 of this Report must be adjusted using the appropriate factors specified in Table 10.3.1 of the AWC NDS. Values are not permitted to be increased for the lumber size adjustment factor in accordance with the AWC NDS.

In accordance with Section 3.5.2 of the AWC NDS, a time-dependent deformation creep factor (K_{cr}) of 2.0 shall apply when calculating total deflection under long-term loading.

4.3 Axial Compression: Tables 12 through 14 of this Report contain axial compression load capacity values for the CLT panels. These values are intended for use in Allowable Stress Design (ASD) and are subject to the conditions noted in the tables. For use in Load and Resistance Factor Design (LRFD), the ASD values shall be multiplied by the appropriate factors specified in Table 10.3.1 of the AWC NDS. Panels subject to a combined in-plane axial compression and out-of-plane transverse loading shall be proportioned in accordance with Sections 3.9.2 and 15.4 of the AWC NDS.

4.4 Fire Resistance: KLH Massivholzplatten CLT layups certified by Intertek to comply with the requirements of ASTM E119 are listed in Table 15 of this Report. The fire resistance rating of layups not included in Table 15 shall be determined by calculation in accordance with Chapter 16 of the AWC NDS.

4.5 Surface-burning Characteristics: The KLH Massivholzplatten CLT has a flame-spread index of 75 or less and a smoke-developed index of 450 or less, when tested in accordance with ASTM E84.

5.0 INSTALLATION

5.1 General:

KLH Massivholzplatten CLT must be installed in accordance with the manufacturer's published installation instructions, the applicable Code, and this Research Report. A copy of the manufacturer's instructions must be available on the jobsite during installation.

6.0 CONDITIONS OF USE

6.1 Installation must comply with this Research Report, the manufacturer's published installation instructions, and the applicable Code. In the event of a conflict, this report governs.

6.2 Cutting, drilling, and notching of KLH Massivholzplatten CLT panels has not been evaluated and is outside the scope of this Report.

6.3 The in-plane shear values listed in Table 11 are applicable for in-plane shear design of CLT diaphragms. The complete diaphragm designs have not been evaluated and are outside the scope of this Report.

6.4 Panels used to resist in-plane shear forces in floor and roof diaphragms shall be accompanied by detailing to complete load path(s) for diaphragm design in accordance with Section 4.5 of the 2021 AWC SDPWS.

6.5 Panels used as roofs shall be covered with approved roof coverings secured to the building or structure in accordance with applicable provisions of Chapter 15 of the IBC.

6.6 Panels used to resist gravity or out-of-plane transverse forces in walls shall be accompanied by complete detailing and wall design acceptable to the code official.

6.7 Panels used to resist in-plane shear forces in shear walls shall be accompanied by detailing to complete load path(s) for shear wall design in accordance with Appendix B of the 2021 AWC SDPWS.

6.8 Panels are limited to use in dry service conditions where the moisture content in service is less than 16%.





6.9 Connections between wall panels and roof/floor panels, and other support members shall be accompanied by complete detailing and design acceptable to the code official. Fasteners and connectors shall be properly specified, including size, length, dimension, fastener bearing length, and location. Connections shall be designed in accordance with the mechanical connection provisions in the AWC NDS or proprietary connectors and fasteners evaluated in a current code evaluation report.

6.9.1 Periodic special inspections shall be conducted in accordance with the applicable requirements of Sections 1704 and 1705 of the IBC.

6.9.2 KLH Massivholzplatten CLT panels are permitted to be used as components in walls, floors, and roofs under the IRC when engineered design is submitted in accordance with Section R301.1.3.

6.9.3 KLH Massivholzplatten CLT panels used in Type IV construction must be protected with noncombustible protection in accordance with Section 602.4 of the IBC.

6.10 KLH Massivholzplatten CLT panels used as floors, interior walls, or exterior walls in Type IV construction shall be a minimum of 4 inches thick.

6.11 KLH Massivholzplatten CLT panels used as roof elements in Type IV construction shall be a minimum of 3 inches thick.

6.12 KLH Massivholzplatten CLT panels are manufactured under a quality control program with inspections by Intertek Testing Services NA, Inc. in the following locations:

- Teufenbach-Katsch, Austria
- Wiesenau, Austria

7.0 SUPPORTING EVIDENCE

7.1 Reports of tests in accordance with ASTM E84 and ASTM E119.

7.2 Data in accordance with the ICC-ES Acceptance Criteria for Cross-laminated Timber Panels for Use as Components in Walls, Floors, and Roofs (AC455), approved February 2021.

7.3 Data in accordance with ANSI/APA PRG 320-19, *Standard for Performance-rated Cross-laminated Timber*.

7.4 Intertek Listing Report "KLH Massivholz GmbH – Massivholzplatten (solid wood slabs) CLT", on the [Intertek Directory of Building Products](#).

8.0 IDENTIFICATION

The KLH Massivholzplatten CLT panels are identified with the manufacturer's name, the product name, the panel grade and layup, the Intertek Mark as shown below, the Intertek Control Number, and the Code Compliance Research Report number (CCRR-0434).



9.0 OTHER CODES

9.1 California Building Code:

The KLH Massivholzplatten CLT panels were evaluated for compliance with Chapters 6 and 23 of the 2025 and 2022 California Building Code.

The KLH Massivholzplatten CLT panels, described in this Research Report, comply with Chapters 6 and 23 of the California Building Code when installed in accordance with the applicable requirements of that code. Use of the CLT panels as part of the seismic force-resisting system is outside the scope of this report.

9.2 Florida Building Code:

The KLH Massivholzplatten CLT panels were evaluated for compliance with Chapters 6 and 23 of the 2023 Florida Building Code.

The KLH Massivholzplatten CLT panels, described in this Research Report, comply with Chapters 6 and 23 of the Florida Building Code when installed in accordance with the applicable requirements of that code. The KLH Massivholzplatten CLT panels comply with the High-Velocity Hurricane Zone (HVHZ) provisions of the *Florida Building Code*.





Intertek is an approved evaluation entity and quality assurance entity pursuant to Florida Statute 553.842 – Product Evaluation and Approval.

10.2 Code Compliance Research Reports shall not be used in any manner that implies an endorsement of the product by Intertek.

10.0 CODE COMPLIANCE RESEARCH REPORT USE

10.1 Approval of building products and/or materials can only be granted by a building official having legal authority in the specific jurisdiction where approval is sought.

10.3 Reference to the <https://bpdirectory.intertek.com> is recommended to ascertain the current version and status of this report.

TABLE 1 - PROPERTIES EVALUATED

PROPERTY	2024 IBC SECTION	2024 IRC SECTION	2025 & 2022 CBC SECTION	2023 FBC SECTION
Physical Properties	2303.1.4	R502.1.6 R602.1.6 R802.1.6	2303.1.4	2303.1.4
Surface-burning Characteristics	803.1.2	R302.9	803.1.2	803.1.1
Type IV Construction	602.4	NA	602.4	602.4.2
Fire Resistance	703.2	R302	703.2	703.2

Note: Section numbers in earlier editions of the codes may differ

TABLE 2 – ASD REFERENCE DESIGN VALUES FOR LAMELLA USED IN KLH MASSIVHOLZPLATTEN CLT PANELS

Grade	Laminations in Major Strength Direction (psi)						Laminations in Minor Strength Direction (psi)					
	F _{b,0}	E ₀ (x10 ⁶)	F _{t,0}	F _{c,0}	F _{v,0}	F _{s,0}	F _{b,90}	E ₉₀ (x10 ⁶)	F _{t,90}	F _{c,90}	F _{v,90}	F _{s,90}
CV1M1	1,340	1.6	550	1450	175	55	1,340	1.6	550	1450	175	55

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TABLE 3 – KLH MASSIVHOLZPLATTEN CLT PANEL 3-PLY LAYUPS

CLT LAYUP ¹	PANEL THICKNESS t_p ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)		
			⊥	
60 3s TL	2.36	0.79	0.79	0.79
70 3s TL	2.76	0.79	1.18	0.79
80 3s TL	3.15	1.18	0.79	1.18
80 3s TL V2	3.15	0.79	1.57	0.79
90 3s TL	3.54	1.18	1.18	1.18
100 3s TL	3.94	1.57	0.79	1.57
100 3s TL V2	3.94	1.18	1.57	1.18
105 3s TL	4.13	1.38	1.38	1.38
110 3s TL	4.33	1.57	1.18	1.57
120 3s TL	4.72	1.57	1.57	1.57
60 3s TT	2.36	0.79	0.79	0.79
70 3s TT	2.76	0.79	1.18	0.79
80 3s TT	3.15	1.18	0.79	1.18
80 3s TT V2	3.15	0.79	1.57	0.79
90 3s TT	3.54	1.18	1.18	1.18
100 3s TT	3.94	1.18	1.57	1.18
100 3s TT V2	3.94	1.57	0.79	1.57
105 3s TT	4.13	1.38	1.38	1.38
110 3s TT	4.33	1.57	1.18	1.57
120 3s TT	4.72	1.57	1.57	1.57

¹The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension, “TL” for major strength direction aligned with the long longitudinal panel dimension).

²Gross thickness of CLT panels.

³Actual thickness of lamination after planing. “||” denotes parallel to the major strength direction of the panel. “⊥” denotes perpendicular to the major strength direction of the panel.



TABLE 4 – KLH MASSIVHOLZPLATTEN CLT PANEL 5-PLY TL LAYUPS

CLT LAYUP ¹	PANEL THICKNESS t_p ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)				
			⊥		⊥	
100 5s TL	3.94	0.79	0.79	0.79	0.79	0.79
110 5s TL	4.33	0.79	0.79	1.18	0.79	0.79
120 5s TL	4.72	1.18	0.79	0.79	0.79	1.18
120 5s TL V2	4.72	0.79	1.18	0.79	1.18	0.79
130 5s TL	5.12	1.18	0.79	1.18	0.79	1.18
130 5s TL V2	5.12	0.79	1.18	1.18	1.18	0.79
140 5s TL	5.51	1.57	0.79	0.79	0.79	1.57
140 5s TL V2	5.51	0.79	1.57	0.79	1.57	0.79
150 5s TL	5.91	1.57	0.79	1.18	0.79	1.57
150 5s TL V2	5.91	1.18	1.18	1.18	1.18	1.18
150 5s TL V3	5.91	0.79	1.57	1.18	1.57	0.79
160 5s TL	6.30	1.57	0.79	1.57	0.79	1.57
160 5s TL V2	6.30	0.79	1.57	1.57	1.57	0.79
170 5s TL	6.69	1.57	1.18	1.18	1.18	1.57
170 5s TL V2	6.69	1.18	1.57	1.18	1.57	1.18
175 5s TL	6.89	1.38	1.38	1.38	1.38	1.38
180 5s TL	7.09	1.57	1.18	1.57	1.18	1.57
180 5s TL V2	7.09	1.18	1.57	1.57	1.57	1.18
190 5s TL	7.48	1.57	1.57	1.18	1.57	1.57
200 5s TL	7.87	1.57	1.57	1.57	1.57	1.57
160 5ss TL	6.30	2 x 1.18	1.57	2 x 1.18		

¹The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).

²Gross thickness of CLT panels.

³Actual thickness of lamination after planing. “||” denotes parallel to the major strength direction of the panel. “⊥” denotes perpendicular to the major strength direction of the panel.





TABLE 5 – KLH MASSIVHOLZPLATTEN CLT PANEL 5-PLY TT LAYUPS

CLT LAYUP ¹	PANEL THICKNESS t_p ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)				
			⊥		⊥	
100 5s TT	3.94	0.79	0.79	0.79	0.79	0.79
110 5s TT	4.33	0.79	0.79	1.18	0.79	0.79
120 5s TT	4.72	1.18	0.79	0.79	0.79	1.18
120 5s TT V2	4.72	0.79	1.18	0.79	1.18	0.79
130 5s TT	5.12	1.18	0.79	1.18	0.79	1.18
140 5s TT	5.51	1.18	0.79	1.57	0.79	1.18
140 5s TT V2	5.51	0.79	1.57	0.79	1.57	0.79
140 5s TT V3	5.51	1.57	0.79	0.79	0.79	1.57
150 5s TT	5.91	1.18	1.18	1.18	1.18	1.18
150 5s TT V2	5.91	1.57	0.79	1.18	0.79	1.57
160 5s TT	6.30	1.57	0.79	1.57	0.79	1.57
175 5s TT	6.89	1.38	1.38	1.38	1.38	1.38
180 5s TT	7.09	1.57	1.18	1.57	1.18	1.57
200 5s TT	7.87	1.57	1.57	1.57	1.57	1.57

¹The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension).

²Gross thickness of CLT panels.

³Actual thickness of lamination after planing. “||” denotes parallel to the major strength direction of the panel. “⊥” denotes perpendicular to the major strength direction of the panel.



TABLE 6 – KLH MASSIVHOLZPLATTEN CLT PANEL 7- AND 8-PLY LAYUPS

CLT LAYUP ¹	PANEL THICKNESS t_p ² (in.)	LAMINATION ACTUAL THICKNESS ³ (in.)						
			⊥		⊥		⊥	
140 7s TL	5.51	0.79	0.79	0.79	0.79	0.79	0.79	0.79
160 7s TL	6.30	0.79	1.18	0.79	0.79	0.79	1.18	0.79
180 7s TL	7.09	0.79	1.57	0.79	0.79	0.79	1.57	0.79
180 7s TL V2	7.09	1.18	0.79	1.18	0.79	1.18	0.79	1.18
200 7s TL	7.87	0.79	1.57	0.79	1.57	0.79	1.57	0.79
210 7s TL	8.27	1.18	1.18	1.18	1.18	1.18	1.18	1.18
220 7s TL	8.66	1.18	1.57	1.18	0.79	1.18	1.57	1.18
220 7s TL V2	8.66	1.57	0.79	1.57	0.79	1.57	0.79	1.57
230 7s TL	9.06	1.18	1.57	1.18	1.18	1.18	1.57	1.18
240 7s TL	9.45	1.18	1.57	1.18	1.57	1.18	1.57	1.18
245 7s TL	9.65	1.38	1.38	1.38	1.38	1.38	1.38	1.38
260 7s TL	10.24	1.57	1.57	1.18	1.57	1.18	1.57	1.57
180 7ss TL	7.09	2 x 1.18	0.79	0.79	0.79	2 x 1.18		
200 7ss TL	7.87	2 x 1.18	0.79	1.57	0.79	2 x 1.18		
210 7ss TL	8.27	2 x 1.18	1.18	1.18	1.18	2 x 1.18		
220 7ss TL	8.66	2 x 1.57	0.79	0.79	0.79	2 x 1.57		
220 7ss TL V2	8.66	2 x 1.18	1.18	1.57	1.18	2 x 1.18		
230 7ss TL	9.06	2 x 1.57	0.79	1.18	0.79	2 x 1.57		
240 7ss TL	9.45	2 x 1.57	0.79	1.57	0.79	2 x 1.57		
250 7ss TL	9.84	2 x 1.57	1.18	1.18	1.18	2 x 1.57		
260 7ss TL	10.24	2 x 1.57	1.18	1.57	1.18	2 x 1.57		
280 7ss TL	11.02	2 x 1.57	1.57	1.57	1.57	2 x 1.57		
180 7s TT	7.09	1.18	0.79	1.18	0.79	1.18	0.79	1.18
300 8ss TL	11.81	2 x 1.57	1.18	2 x 1.57	1.18	2 x 1.57		
320 8ss TL	12.60	2 x 1.57	1.57	2 x 1.57	1.57	2 x 1.57		

¹The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension, “TL” for major strength direction aligned with the long longitudinal panel dimension).

²Gross thickness of CLT panels.

³Actual thickness of lamination after planing. “||” denotes parallel to the major strength direction of the panel. “⊥” denotes perpendicular to the major strength direction of the panel.



TABLE 7 – REFERENCE DESIGN VALUES FOR KLH MASSIVHOLZPLATTEN CLT PANEL 3-PLY LAYUPS¹

CLT LAYUP ²	Major Strength Direction					Minor Strength Direction				
	$F_b S_{eff,0}$ (lb-ft/ft)	$EI_{eff,0}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,0}$ ($\times 10^6$ lb/ft)	$V_{s,0}$ (lb/ft)	$F_c A_0$ (lb/ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$EI_{eff,90}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,90}$ ($\times 10^6$ lb/ft)	$V_{s,90}$ (lb/ft)	$F_c A_{90}$ (lb/ft)
60 3s TL	1021	20.3	0.26	1039	27,402	138	0.78	0.26	346	13,701
70 3s TL	1332	30.9	0.27	1213	27,402	312	2.64	0.39	520	20,551
80 3s TL	1855	49.2	0.39	1386	41,102	138	0.78	0.27	346	13,701
80 3s TL V2	1656	43.9	0.30	1386	27,402	554	6.25	0.54	693	27,402
90 3s TL	2298	68.6	0.38	1559	41,102	312	2.64	0.38	520	20,551
100 3s TL	2920	96.9	0.54	1732	54,803	138	0.78	0.30	346	13,701
100 3s TL V2	2760	91.6	0.40	1732	41,102	554	6.25	0.51	693	27,402
105 3s TL	3128	109	0.45	1819	47,954	424	4.19	0.45	606	23,977
110 3s TL	3491	127	0.51	1906	54,803	312	2.64	0.40	520	20,551
120 3s TL	4085	163	0.51	2079	54,803	554	6.25	0.51	693	27,402
60 3s TT	1021	20.3	0.26	1039	27,402	138	0.78	0.26	346	13,701
70 3s TT	1332	30.9	0.27	1213	27,402	312	2.64	0.39	520	20,551
80 3s TT	1855	49.2	0.39	1386	41,102	138	0.78	0.27	346	13,701
80 3s TT V2	1656	43.9	0.30	1386	27,402	554	6.25	0.54	693	27,402
90 3s TT	2298	68.6	0.38	1559	41,102	312	2.64	0.38	520	20,551
100 3s TT	2760	91.6	0.40	1732	41,102	554	6.25	0.51	693	27,402
100 3s TT V2	2920	96.9	0.54	1732	54,803	138	0.78	0.30	346	13,701
105 3s TT	3128	109	0.45	1819	47,954	424	4.19	0.45	606	23,977
110 3s TT	3491	127	0.51	1906	54,803	312	2.64	0.40	520	20,551
120 3s TT	4085	163	0.51	2079	54,803	554	6.25	0.51	693	27,402

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension, “TL” for major strength direction aligned with the long longitudinal panel dimension).



TABLE 8 – REFERENCE DESIGN VALUES FOR KLH MASSIVHOLZPLATTEN CLT PANEL 5-PLY TL LAYUPS¹

CLT LAYUP ²	Major Strength Direction					Minor Strength Direction				
	F _b S _{eff,0} (lb-ft/ft)	E _I _{eff,0} (x10 ⁶ lb-in ² /ft)	G _A _{eff,0} (x10 ⁶ lb/ft)	V _{s,0} (lb/ft)	F _c A ₀ (lb/ft)	F _b S _{eff,90} (lb-ft/ft)	E _I _{eff,90} (x10 ⁶ lb-in ² /ft)	G _A _{eff,90} (x10 ⁶ lb/ft)	V _{s,90} (lb/ft)	F _c A ₉₀ (lb/ft)
100 5s TL	2351	78	0.51	1732	41,102	1202	20	0.51	1039	27,402
110 5s TL	2743	100	0.64	1906	47,953	1567	31	0.52	1213	27,402
120 5s TL	3744	149	0.64	2079	54,803	1202	20	0.52	1039	27,402
120 5s TL V2	3042	121	0.54	2079	41,102	2182	49	0.77	1386	41,102
130 5s TL	4281	185	0.77	2252	61,653	1567	31	0.54	1213	27,402
130 5s TL V2	3437	148	0.65	2252	47,953	2704	69	0.76	1559	41,102
140 5s TL	5345	248	0.77	2425	68,504	1202	20	0.54	1039	27,402
140 5s TL V2	3752	174	0.60	2425	41,102	3435	97	1.08	1732	54,803
150 5s TL	6021	300	0.92	2598	75,354	1567	31	0.57	1213	27,402
150 5s TL V2	5289	263	0.77	2598	61,653	2704	69	0.77	1559	41,102
150 5s TL V3	4148	206	0.69	2598	47,953	4106	127	1.04	1906	54,803
160 5s TL	6736	358	1.08	2772	82,205	1948	44	0.60	1386	27,402
160 5s TL V2	4574	243	0.80	2772	54,803	4806	163	1.02	2079	54,803
160 5ss TL	7419	394	0.77	2772	82,205	554	6	0.54	693	27,402
170 5s TL	7329	413	0.89	2945	75,354	2704	69	0.78	1559	41,102
170 5s TL V2	6322	357	0.80	2945	61,653	4106	127	1.02	1906	54,803
175 5s TL	7200	418	0.89	3032	71,932	3680	109	0.89	1819	47,954
180 5s TL	8054	481	1.02	3118	82,205	3247	92	0.80	1732	41,102
180 5s TL V2	6904	412	0.91	3118	68,504	4806	163	1.02	2079	54,803
190 5s TL	8670	547	0.91	3291	75,354	4106	127	1.02	1906	54,803
200 5s TL	9403	624	1.02	3465	82,205	4806	163	1.02	2079	54,803

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).



TABLE 9 – REFERENCE DESIGN VALUES FOR KLH MASSIVHOLZPLATTEN CLT PANEL 5-PLY TT LAYUPS¹

CLT LAYUP ²	Major Strength Direction					Minor Strength Direction				
	$F_b S_{eff,0}$ (lb-ft/ft)	$EI_{eff,0}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,0}$ ($\times 10^6$ lb/ft)	$V_{s,0}$ (lb/ft)	$F_c A_0$ (lb/ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$EI_{eff,90}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,90}$ ($\times 10^6$ lb/ft)	$V_{s,90}$ (lb/ft)	$F_c A_{90}$ (lb/ft)
100 5s TT	2351	78	0.51	1732	41,102	1202	20	0.51	1039	27,402
110 5s TT	2743	100	0.64	1906	47,953	1567	31	0.52	1213	27,402
120 5s TT	3744	149	0.64	2079	54,803	1202	20	0.52	1039	27,402
120 5s TT V2	3042	121	0.54	2079	41,102	2182	49	0.77	1386	41,102
130 5s TT	4281	185	0.77	2252	61,653	1567	31	0.54	1213	27,402
140 5s TT	4857	226	0.92	2425	68,504	1948	44	0.57	1386	27,402
140 5s TT V2	3752	174	0.60	2425	41,102	3435	97	1.08	1732	54,803
140 5s TT V3	5345	248	0.77	2425	41,102	1202	20	0.54	1039	54,803
150 5s TT	5289	263	0.77	2598	61,653	2704	69	0.77	1559	41,102
150 5s TT V2	6021	300	0.92	2598	75,354	1567	31	0.57	1213	27,402
160 5s TT	6736	358	1.08	2772	82,205	1948	44	0.60	1386	27,402
175 5s TT	7200	418	0.89	3032	71,932	3680	109	0.89	1819	47,954
180 5s TT	8054	481	1.02	3118	82,205	3247	92	0.80	1732	41,102
200 5s TT	9403	624	1.02	3465	82,205	4806	163	1.02	2079	54,803

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension).



TABLE 10 – REFERENCE DESIGN VALUES FOR KLH MASSIVHOLZPLATTEN CLT PANEL 7- AND 8-PLY LAYUPS¹

CLT LAYUP ²	Major Strength Direction					Minor Strength Direction				
	$F_b S_{eff,0}$ (lb-ft/ft)	$E_{eff,0}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,0}$ ($\times 10^6$ lb/ft)	$V_{s,0}$ (lb/ft)	$F_c A_0$ (lb/ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$E_{eff,90}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,90}$ ($\times 10^6$ lb/ft)	$V_{s,90}$ (lb/ft)	$F_c A_{90}$ (lb/ft)
140 7s TL	4158	193	0.77	2425	54,803	2766	78	0.77	1732	41,102
160 7s TL	4830	256	0.80	2772	54,803	4405	149	1.02	2079	54,803
180 7s TL	5526	330	0.84	3118	54,803	6288	248	1.30	2425	68,504
180 7s TL V2	7599	454	1.16	3118	82,205	3579	121	0.82	2079	41,102
180 7ss TL	9205	550	1.08	3118	95,905	1202	20	0.60	1039	27,402
200 7s TL	6582	437	0.89	3465	54,803	7925	358	1.62	2772	82,205
200 7ss TL	11133	739	1.42	3465	109,606	1948	44	0.65	1386	27,402
210 7s TL	9356	652	1.15	3638	82,205	6223	263	1.15	2598	61,653
210 7ss TL	12025	838	1.16	3638	102,756	2704	69	0.82	1559	41,102
220 7s TL	9597	701	1.16	3811	82,205	7808	352	1.27	2772	68,504
220 7s TL V2	11976	874	1.62	3811	109,606	4414	174	0.89	2425	41,102
220 7ss TL	13972	1020	1.42	3811	123,307	1202	20	0.65	1039	27,402
220 7ss TL V2	13031	951	1.30	3811	109,606	3247	92	0.84	1732	41,102
230 7s TL	10358	791	1.18	3984	82,205	8622	413	1.40	2945	75,354
230 7ss TL	15175	1158	1.61	3984	130,157	1567	31	0.68	1213	27,402
240 7s TL	11146	888	1.19	4158	82,205	9476	481	1.53	3118	82,205
245 7s TL	12735	1035	1.34	4244	95,909	8470	418	1.34	3032	71,932
260 7s TL	14535	1254	1.30	4504	95,905	9476	481	1.53	3118	82,205

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).





TABLE 10 (CONTINUED) – REFERENCE DESIGN VALUES FOR KLH MASSIVHOLZPLATTEN CLT PANEL 7- AND 8-PLY LAYUPS¹

CLT LAYUP ²	Major Strength Direction					Minor Strength Direction				
	$F_b S_{eff,0}$ (lb-ft/ft)	$E_{eff,0}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,0}$ ($\times 10^6$ lb/ft)	$V_{s,0}$ (lb/ft)	$F_c A_0$ (lb/ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$E_{eff,90}$ ($\times 10^6$ lb-in ² /ft)	$GA_{eff,90}$ ($\times 10^6$ lb/ft)	$V_{s,90}$ (lb/ft)	$F_c A_{90}$ (lb/ft)
240 7ss TL	16417	1307	1.80	4157	137,008	1948	44	0.71	1386	27,402
250 7ss TL	17591	1459	1.46	4331	130,157	2704	69	0.87	1559	41,102
260 7ss TL	18867	1628	1.62	4504	137,008	3247	92	0.89	1732	41,102
280 7ss TL	21378	1986	1.54	4850	137,008	4806	163	1.09	2079	54,803
180 7s TT	7599	454	1.16	3118	82,205	3579	121	0.82	2079	41,102
300 8ss TL	24366	2426	2.32	5197	164,409	5561	220	1.01	2425	41,102
320 8ss TL	26945	2861	2.15	5543	164,409	7791	352	1.19	2772	54,803

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension, “TL” for major strength direction aligned with the long longitudinal panel dimension).

TABLE 11 – REFERENCE DESIGN VALUES FOR IN-PLANE SHEAR FOR KLH MASSIVHOLZPLATTEN CLT PANELS¹

Layup ²	Thickness (in.)	Major Strength Direction		Minor Strength Direction	
		$F_{v,e,0}$ ³ (psi)	$F_{v,e,0} t_p$ ⁴ (lb/ft)	$F_{v,e,90}$ ³ (psi)	$F_{v,e,90} t_p$ ⁴ (lb/ft)
100 3S TL V2	3.92	254	11,900	254	11,900
100 3S TT	3.92	254	11,900	254	11,900
160 5S TL	6.25	254	19,000	179	13,400
160 5S TT	6.25	254	19,000	179	13,400

¹The tabulated values are reference design values intended for Allowable Stress Design (ASD) and must be adjusted in accordance with Section 4.2.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TT” for major strength direction aligned with the short transverse panel dimension, “TL” for major strength direction aligned with the long longitudinal panel dimension).

³The tabulated values are ASD reference edgewise shear stress oriented in the major ($F_{v,e,0}$) and minor ($F_{v,e,90}$) strength direction.

⁴The tabulated values are ASD reference edgewise shear capacity of the full CLT panel thickness oriented in the major ($F_{v,e,0} t_p$) and minor ($F_{v,e,90} t_p$) strength direction.



TABLE 12 – AXIAL COMPRESSION LOAD CAPACITY, P_c' (lb/ft), FOR KLH MASSIVHOLZPLATTEN CLT PANEL 3-PLY LAYUPS¹

CLT LAYUP ²	PANEL THICKNESS (in.)	WALL PANEL HEIGHT (FT)					
		8	10	12	14	16	18
60 3s TL	2.36	10,612					
70 3s TL	2.76	15,233	10,343				
80 3s TL	3.15	23,980	16,406	11,686			
80 3s TL V2	3.15	19,494	14,068	10,196			
90 3s TL	3.54	29,987	21,879	15,917	11,944		
100 3s TL	3.94	41,251	30,577	22,371	16,824	13,044	
100 3s TL V2	3.94	34,115	27,184	20,519	15,620	12,180	
105 3s TL	4.13	40,078	32,157	24,361	18,572	14,491	
110 3s TL	4.33	46,143	37,310	28,386	21,677	16,926	13,528
120 3s TL	4.72	48,988	42,700	34,347	26,883	21,223	17,058

¹The tabulated capacity, P_c' , values are intended for Allowable Stress Design (ASD) and are valid for the following conditions: Where P_c' values are not given in the table, the slenderness ratio, l/d , exceeds 50. Equation C3.7.1-1 of the 2018 AWC NDS was used in the determination of P_c' values. No adjustments were applied for duration of load, end fixity, or eccentricity.

²The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).

TABLE 13 – AXIAL COMPRESSION LOAD CAPACITY, P_c' (lb/ft), FOR KLH MASSIVHOLZPLATTEN CLT PANEL 5-PLY LAYUPS¹

CLT LAYUP ²	PANEL THICKNESS (in.)	WALL PANEL HEIGHT (FT)								
		8	10	12	14	16	18	20	22	24
100 5s TL	3.94	31,900	24,085	17,745	13,382	10,388				
110 5s TL	4.33	38,747	30,137	22,484	17,038	13,257	10,576			
120 5s TL	4.72	48,078	40,832	32,103	24,858	19,530	15,659			
120 5s TL V2	4.72	36,604	31,737	25,399	19,830	15,638	12,562			
130 5s TL	5.12	55,161	48,143	38,775	30,368	23,981	19,277	15,782		
130 5s TL V2	5.12	43,073	37,808	30,627	24,057	19,022	15,301	12,531		
140 5s TL	5.51	63,145	57,602	48,918	39,525	31,667	25,638	21,073	17,582	
140 5s TL V2	5.51	38,483	35,920	31,646	26,334	21,425	17,478	14,425	12,065	
150 5s TL	5.91	70,205	65,062	56,625	46,617	37,705	30,670	25,273	21,118	17,880
150 5s TL V2	5.91	57,818	54,093	47,851	39,973	32,592	26,617	21,980	18,390	15,583
150 5s TL V3	5.91	44,954	42,035	37,150	31,007	25,269	20,631	17,035	14,251	12,075
160 5s TL	6.30	77,256	72,497	64,482	54,156	44,293	36,231	29,944	25,065	21,245
160 5s TL V2	6.30	51,504	48,331	42,988	36,104	29,529	24,154	19,963	16,710	14,164
170 5s TL	6.69	72,036	69,147	64,266	56,954	48,407	40,436	33,797	28,474	24,231
170 5s TL V2	6.69	59,098	56,915	53,252	47,670	40,888	34,348	28,797	24,304	20,704
175 5s TL	6.89	68,981	66,470	62,260	55,830	47,965	40,335	33,836	28,566	24,340
180 5s TL	7.09	78,872	76,047	71,317	64,073	55,150	46,431	38,976	32,918	28,054
180 5s TL V2	7.09	65,802	63,531	59,742	53,909	46,603	39,347	33,083	27,965	23,846
190 5s TL	7.48	73,019	71,188	68,258	63,674	57,240	49,808	42,648	36,433	31,262
200 5s TL	7.87	79,792	77,929	74,976	70,371	63,801	55,957	48,170	41,281	35,490

¹ The tabulated capacity, P_c' , values are intended for Allowable Stress Design (ASD) and are valid for the following conditions: Where P_c' values are not given in the table, the slenderness ratio, l/d , exceeds 50. Equation C3.7.1-1 of the 2018 AWC NDS was used in the determination of P_c' values. No adjustments were applied for duration of load, end fixity, or eccentricity.

² The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier ("s" for standard perpendicular layers), and a panel orientation identifier ("TL" for major strength direction aligned with the long longitudinal panel dimension).



TABLE 14 – AXIAL COMPRESSION LOAD CAPACITY, P_c' (lb/ft), FOR KLH MASSIVHOLZPLATTEN CLT PANEL 7-PLY LAYUPS¹

CLT LAYUP ²	PANEL THICKNESS (in.)	WALL PANEL HEIGHT (FT)								
		8	10	12	14	16	18	20	22	24
140 7s TL	5.51	50,261	45,502	38,234	30,674	24,491	19,795	16,255	13,555	
160 7s TL	6.30	51,758	48,902	44,052	37,499	30,926	25,405	21,044	17,639	14,963
180 7s TL	7.09	52,609	50,756	47,660	42,905	37,003	31,193	26,204	22,140	18,873
180 7s TL V2	7.09	78,599	75,465	70,170	62,229	52,922	44,223	36,970	31,150	26,510
180 7ss TL	7.09	91,939	88,554	82,874	74,215	63,680	53,506	44,865	37,867	32,260
200 7s TL	7.87	53,252	52,065	50,198	47,294	43,114	38,018	32,853	28,219	24,294
200 7ss TL	7.87	105,913	102,949	98,132	90,593	80,346	69,117	58,753	49,977	42,777
210 7s TL	8.27	79,903	78,148	75,392	71,109	64,930	57,352	49,619	42,652	36,737
210 7ss TL	8.27	100,010	97,940	94,718	89,737	82,489	73,377	63,820	55,040	47,500
220 7s TL	8.66	80,085	78,502	76,054	72,287	66,777	59,728	52,173	45,119	39,004
220 7s TL V2	8.66	106,584	104,289	100,694	95,117	87,046	77,065	66,788	57,471	49,531
220 7ss TL	8.66	120,076	117,652	113,893	108,095	99,635	88,895	77,496	66,933	57,816
220 7ss TL V2	8.66	106,885	104,871	101,779	97,044	90,095	81,052	71,134	61,708	53,446
230 7s TL	9.06	80,365	79,036	77,034	74,015	69,572	63,566	56,567	49,547	43,174
230 7ss TL	9.06	127,029	124,730	121,223	115,876	108,014	97,647	86,057	74,864	64,954
240 7s TL	9.45	80,595	79,465	77,800	75,347	71,761	66,771	60,551	53,826	47,367
240 7ss TL	9.45	133,973	131,785	128,495	123,544	116,256	106,375	94,796	83,118	72,475
245 7s TL	9.65	94,041	92,730	90,801	87,961	83,812	78,034	70,816	62,990	55,455

¹ The tabulated capacity, P_c' , values are intended for Allowable Stress Design (ASD) and are valid for the following conditions: Where P_c' values are not given in the table, the slenderness ratio, l/d , exceeds 50. Equation C3.7.1-1 of the 2018 AWC NDS was used in the determination of P_c' values. No adjustments were applied for duration of load, end fixity, or eccentricity.

² The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers, “ss” for duplicate outer and/or central layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).



TABLE 15 – KLH MASSIVHOLZPLATTEN CLT PANEL LAYUPS BEARING FIRE RESISTANCE RATINGS

CLT LAYUP ¹	PANEL USE	MAXIMUM LOAD ²	FIRE RESISTANCE
130 5s TL	Loaded Roof ³	19% of Design Load	60 min w/ hose
160 5s TL	Loaded Floor	50% of Design Load	60 min w/ hose
175 5s TL	Loaded Floor	25% of Design Load	120 min w/ hose
175 5s TL	Loaded Wall	12% of Design Load	120 min w/ hose
180 5s TL	Loaded Floor	38% of Design Load	120 min w/ hose

¹ The layups are developed based on ANSI/APA PRG 320, using custom CLT Grade CV1M1. The layup designation refers to the panel thickness (in mm), the number of layers, a layup configuration identifier (“s” for standard perpendicular layers), and a panel orientation identifier (“TL” for major strength direction aligned with the long longitudinal panel dimension).

² The tabulated percentages are based on ASD reference design values calculated in accordance with Chapter 10 of the NDS.

³ From bottom to top, the certified roof assembly consists of the 130 5s TL panel, Carlisle WIP 300HT self-adhesive rubberized asphalt underlayment, two layers of 2.2-inch polyisocyanurate insulation, a 1/4-inch Securock Gypsum-Fiber Roof Board, and a 60-mil TPO roofing membrane.

