MERCER
mass timber

Mercer Mass Timber

PRODUCT CATALOG

Technical Specifications

October 2022

TABLE OF CONTENTS

INTRODUCTION

This document defines Mercer's cross-laminated timber (CLT) product line, manufactured for use in commercial building projects in the United States and Canada. The document is intended for use by representatives of architecture, engineering, and construction to properly design, specify, and construct buildings using Mercer CLT. The definition herein represents the product line currently available from the Mercer CLT Factory located in Spokane Valley, WA.

Mercer CLT is a premanufactured, prefabricated, engineered solid wood building material composed of Mercer-specified lumber (aka laminations) stacked crosswise at 90-degree angles in multiple layers (aka plies) and bonded together under high pressure using structural adhesives.

The large format size, cross-layer makeup, and high strength-to-weight ratio position Mercer CLT as a high-performance substitute for conventional concrete, masonry, and steel, as well as wood truss and joist floors.

Mercer CLT is manufactured and tested for its intended use in compliance with the 2018 International Building Code (IBC) and all relevant reference standards including ANSI/APA PRG 320 (2019) ready for use in the United States. Our product is also certified for use in Canada to meet the requirements of CSA O86 (2019).

1. MERCER CLT PRODUCT DEFINITION

Mercer CLT panels offer maximum dimensions of 12 ft (3.66m) wide by 60 ft (18.28m) long and a range of thicknesses from 3.24 in (82.5mm) to 12.40 (315mm) in in 3, 5, 7, and 9-ply layups. The product is available in the following:

- Spruce Pine Fir or Douglas Fir-Larch species combination
- Visually graded or higher strength mechanically stress graded lumber laminations
- Industrial or Architectural appearance classification
- Chain-of-custody forest stewardship certification

Mercer CLT panels are primarily intended for use as the structural substrate for floor and roof assemblies, but they are also suited for bearing or shear wall assemblies in the appropriate code-compliant application.

Further definition of our product is provided in our 3rd party product evaluation reports:

US: PFS-TECO BPER 0141

1.1 PANEL APPLICATIONS

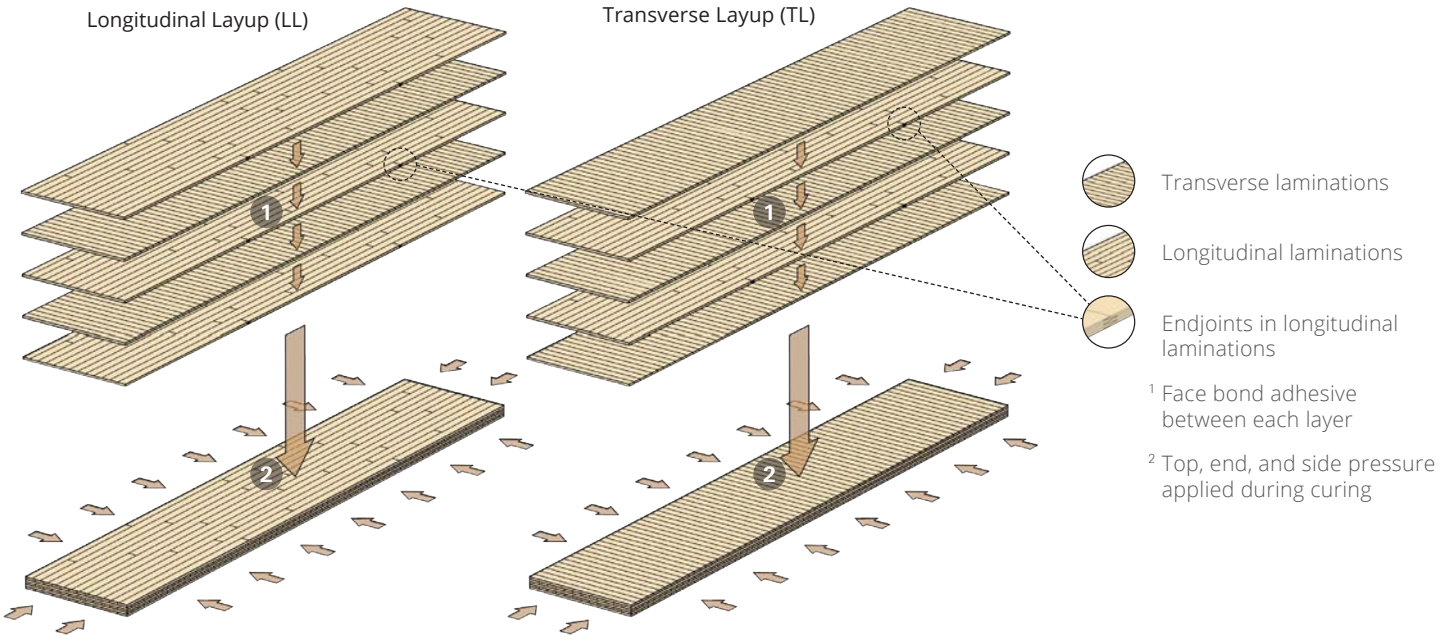
Mercer CLT panels are primarily intended for one-way slab span behavior in the panel strong direction for out-of-plane loads and acts as the floor/roof diaphragm without the addition of plywood sheathing or structural concrete topping for in-plane loading. The bottom face of appropriately-sized floor panels may be visually exposed and achieve a 1- or 2-hour fire resistance rating through charring of the wood.

The width of laminations (boards) in outer visible layers and inner layers of panels are nominally 6 in. Architectural and Industrial Appearance surface classifications are available, where an Architectural Appearance surface classification may be specified on one, both, or neither of the faces of the panel. Our CLT is compatible with a number of different surface treatments (i.e., painted, stained, sealed, etc.), which should be evaluated on a project-by-project basis.

Longitudinal boards are end jointed (finger-jointed) at random lengths to create continuous boards from which the master panel is laid up. End joints are cut parallel to the wide face of laminations, thus the fingers will be visible on the narrow face of boards. Transverse boards are continuous and do not contain finger joints.

Finished panels are accurately fabricated from full master panels to the user-specified size, shape, and level of detail by state-of-the-art CNC machines to provide precise field fit. The following section presents a summary of representative subtractive fabrication capabilities in the factory for edge connections. Consult with Mercer on a project basis to review the manufacturability of the proposed CLT panelization, holes, and edge cut fabrication at early design stages.

Construction of a 5-ply Mercer CLT Master Panel



1.2 PANEL CHARACTERISTICS

Characteristics	Features	
Panel Dimensions	Length Width	finished max length = 60'-0" (18.29m) finished max width = 11'-9" (3.58m)
Panel Thickness	(See Layup Panel Table in Section 1.3)	
Laminations	Layers (plies) Orientation Thickness Width	3, 5, 7, and 9 Cross lamination Post-planed: 27.5mm–35mm (1.08–1.38 in) Post-planed: 135mm-180mm (5.25–7.09 in)
Species Combinations	Spruce-Pine-Fir (SPF) Douglas fir-Larch (DF-L)	
Adhesives	Face bonding End joints	1-component polyurethane (formaldehyde-free) 2-component melamine formaldehyde with RF curing
Finish Panel Tolerances at the Time of Manufacturing	Thickness Width Length Squareness Straightness	+/- 1/16" or 2% of panel thickness, whichever is greater +/- 1/8" +/- 1/4" 1/8" max – (difference in length two panel face diagonals measured between corners) 1/16" max – (deviation of edges from a straight line between adjacent panel corners)
Finish Panel Cut Out Tolerances	Fabrication tolerances for panel cut-outs, notching, and openings using factory CNC equipment will generally be +/- 3/16"	
Moisture Content	12% +/- 3% (each lamination at the time of manufacture)	
Surface Classification Options	Industrial Appearance (IA) Architectural Appearance (AA)	
Density	Dependent on species and moisture content. Refer to the National Design Specification (NDS) for Wood Construction. Assume 32 lb/ft^3 for transport and lifting.	
Use Conditions	Dry (Ref PRG 320 – Section 1 – Scope)	
Panel Orientation	Longitudinal layup (LL) and Transverse layup (TL) panels are available in 3-, 5-, and 7-ply. 9-ply is LL only.	
Edge Sealer	When specified, panel edge and cutout faces with exposed lamination end grain are coated with a clear factory applied end-grain sealer.	
Edge Chamfer	When specified for architectural appearance grade panels, a chamfer is provided at the visible panel-to-panel abutted edges.	
Structural Design Values	Refer to Section 2 and 3rd Party Mercer CLT Building Product Report: PFS-TECO BPER 0141	

1.3 APPEARANCE CLASSIFICATIONS

Mercer produces two appearance classifications to achieve the project's visual appearance requirements. An Architectural Appearance (AA) surface classification may be specified for the top, bottom, or both faces of a panel. Unless otherwise specified, the top side of CLT panels used in floor or roof applications have an Industrial Appearance (IA) classification. The following table presents the visual characteristics of each surface classification.

Characteristic	Industrial Appearance (IA)[1,2]	Architectural Appearance (AA)[1,2]
Surface finish	Sanded, 80-100 grit	Sanded, 80-100 grit
Color and texture	Not specified	Well-balanced color and texture
Blue/Brown stain	Permitted	Up to 5% of area max permitted
Knots (i.e., intergrown, spike, loose)	At edge: 1-7/8" max dia At centerline: 2-7/8" max dia	At edge: 1-7/8" max dia At centerline: 2-7/8" max dia
Knot holes	1-1/2" max dia	At centerline: 1" max dia
Resin (Pitch) pockets	Permitted	3/4" max dia.
Pith	Permitted	Occasionally permitted, 3/8" x 3" max, or the equivalent in square inches
Bark ingrowth	Permitted	Occasional pith up to a length of 36" permitted
Wane	1/3 the thickness and 1/3 the width full length, or equivalent on each face, provided wane does not exceed 2/3 the thickness or 1/2 the width for up to 1/4 the length.	Not permitted
Compression wood	Permitted	Permitted
Insect damage	Occasionally permitted	Not permitted
Decay (unsound wood)	Honeycomb or peck are limited to 1/6 the width. Any other unsound wood is limited to a spot 1/12 the width and 2" in length or smaller.	Not permitted
Wood shake, splits, checks (at manufactured MC reference)	Permitted	Occasional surface cracks permitted, occasional end shakes, up to 2" length
Sapwood	Permitted	Permitted
Gaps between adjacent lamination edges	Tightly fit[3]	Tightly fit[3]

[1] The specified surface qualities are only valid for the outer layer(s) at the time of manufacturing, and therefore are not applicable to the end grain (narrow faces) of the panel.

[2] Like all wood products, the above stated qualities are at the time of manufacturing and subject to crack and joint formation as a result of normal drying to the equilibrium moisture content of the location and conditions wherein the product is finally installed. Refer to the Mercer CLT Product Care Manual for recommendations for protection during transportation, site storage, and installation.

[3] Mercer CLT is manufactured with end and side pressure applied during pressing. This process assures conformance to 2019 PRG 320 Section 6.1.8 definition of 'tightly fit' at the time of manufacture. Occasional gaps of up to ¼" are allowed on face layers.

1.4 FIRE PERFORMANCE

Characteristic	Reference Standard	Value[1]
Fire resistance rating	ASTM E119, CAN/ULC-S101	Floor and Roof 1-hr, Floor 2-hr
Nominal char rate (β_n)	—	1.5 in/hr[2]
Spread of flame and smoke index rating	ASTM E84	Class B
Through-penetration fire stopping	ASTM E814	1- and 2-hour

[1] CLT product has been tested in accordance the reference standard stated in third-party accredited laboratories. Consult Mercer for specific products tested and performance requirements that have been met.

[2] One dimensional nominal char rate substantiated through ASTM E119 testing. Contact Mercer for additional information.

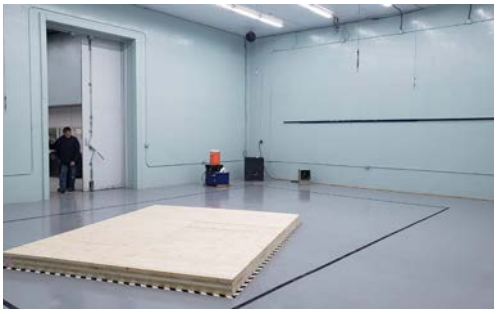
Mercer CLT - Char Rate Testing

1.5 ACOUSTIC PERFORMANCE OF BARE CLT

Characteristic	Standard	Value
Airborne Sound Transmission Class (STC)[1,2]	ASTM E90	CLT5-137: STC = 41
Impact Insulation Class (IIC)[1,2]	ASTM E492	CLT5-137: IIC = 27
Sound Absorption (NRC)	ASTM C423	NRC = 0.05, SAA = 0.05

[1] CLT may need to be integrated into an assembly with supplemental materials to achieve desired acoustic performance.

[2] CLT product has been tested per the reference standards in third-party accredited laboratories. Consult Mercer for specific products tested and performance requirements that have been met.



Mercer CLT - Acoustic NRC Testing

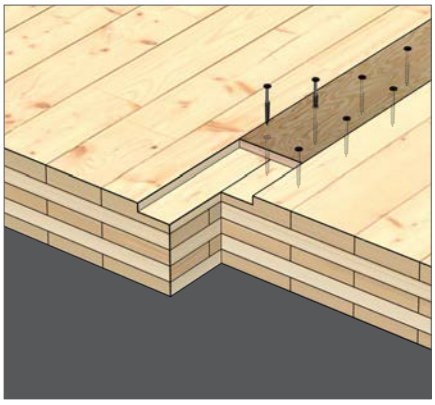
1.6 ENVIRONMENTAL CERTIFICATIONS

Agency	Standard
Forest Stewardship Certifications: PEFC	Mercer Factory Chain of Custody[1]
Forest Stewardship Certifications: FSC®	Mercer Factory Chain of Custody[1]

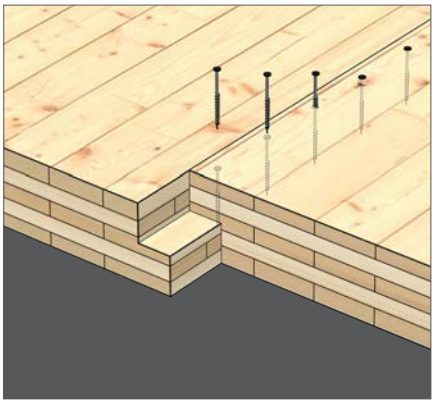
[1] Chain of custody certification provided upon project request for the forest stewardship program specified. Consult with Mercer about layup availability for the certification requested.

1.7 TYPICAL PANEL-TO-PANEL CONNECTION CONFIGURATIONS

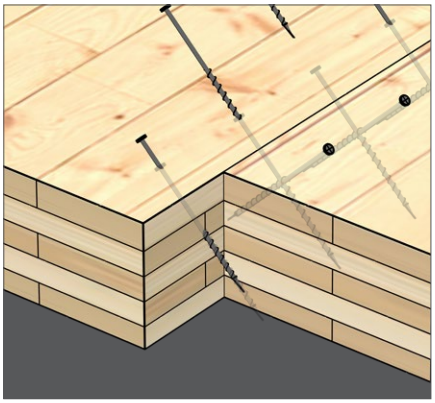
Mercer has the capabilities to prefabricate CLT Flat Panels for quick and accurate onsite installation using state-of-the-art CNC equipment located in its Spokane Valley manufacturing facility. Used as floor or roof panels, we recommend the following panel-to-panel connections configurations to ensure strength, stiffness, fire, vibration, and acoustic performance requirements of the application are met.



CLT to CLT Spline



CLT to CLT Half Lap



CLT to CLT Spline

CLT to CLT Half Lap

TABLE 1

ASD Reference Design Values[a] for Laminations Used in Mercer CLT

Allowable Design Properties for Laminations Used in Mercer CLT

CLT Grade	Major Strength Direction						Minor Strength Direction					
	$f_{b,o}$ (psi)	E (10^6 psi)	$f_{t,0}$ (psi)	$f_{c,0}$ (psi)	$f_{v,0}$ (psi)	$f_{s,0}$ (psi)	$f_{b,90}$ (psi)	E (10^6 psi)	$f_{t,90}$ (psi)	$f_{c,90}$ (psi)	$f_{v,90}$ (psi)	$f_{s,90}$ (psi)
1.4V[b]	875	1.4	450	1,150	135	45	500	1.2	250	650	135	45
1.8M[c]	2,100	1.8	1,575	1,875	160	50	500	1.2	250	650	135	45

For SI: 1 psi = 0.006895 MPa

[a] Tabulated values are allowable design values and are not permitted to be increased for the lumber size adjustment factor in accordance with the NDS. 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 Tables 2 and 3).

[b] 1.4V grade design values are approved for SPF and DF-L laminations. Major strength direction laminations for each species group shall be visually- and/or electronically-graded lamstock with design values that equal or exceed the 1.4V design values in Table 1.

[c] 1.8M grade design values are approved for SPF and DF-L laminations. Major strength direction laminations for each species group shall be electronically-graded lamstock with design values that equal or exceed the 1.8 M design values in Table 1.

TABLE 2 | PART 1

ASD Reference Flatwise Design Values[a][b] for Mercer CLT

CLT Grade	CLT Layup	CLT Thickness, t_p (in)	Lamination Thicknesses in CLT Layup (in)								
			=	⊥	=	⊥	=	⊥	=	⊥	=
1.4V[c]	CLT3-082	3.24	1.08	1.08	1.08						
	CLT3-90	3.54	1.18	1.18	1.18						
	CLT3-090T	3.54	1.08	1.38	1.08						
	CLT3-097	3.84	1.38	1.08	1.38						
	CLT3-100	3.94	1.38	1.18	1.38						
	CLT3-105	4.14	1.38	1.38	1.38						
	CLT5-137	5.40	1.08	1.08	1.08	1.08	1.08				
	CLT5-150	5.91	1.18	1.18	1.18	1.18	1.18				
	CLT5-152T	6.00	1.08	1.38	1.08	1.38	1.08				
	CLT5-160	6.30	1.38	1.08	1.38	1.08	1.38				
	CLT5-175	6.90	1.38	1.38	1.38	1.38	1.38				
	CLT7-222	8.76	1.38	1.08	1.38	1.08	1.38	1.08	1.38		
	CLT7-245	9.66	1.38	1.38	1.38	1.38	1.38	1.38	1.38		
	CLT9-285	11.22	1.38	1.08	1.38	1.08	1.38	1.08	1.38	1.08	1.38
	CLT9-315	12.42	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
1.8M[d]	CLT3-097	3.84	1.38	1.08	1.38						
	CLT3-105	4.14	1.38	1.38	1.38						
	CLT5-160	6.30	1.38	1.08	1.38	1.08	1.38				
	CLT5-175	6.90	1.38	1.38	1.38	1.38	1.38				

TABLE 2 | PART 1

ASD Reference Flatwise Design Values[a][b] for Mercer CLT

CLT Grade	CLT Layup	CLT Thickness, t_p (in)	Major Strength Direction				Minor Strength Direction			
			$F_b S_{eff,0}$ (lb-ft/ft)	$EI_{eff,0}$ (10^6 lb-in²/ft)	$GA_{eff,0}$ (10^6 lb/ft)	$V_{s,0}$ (lb/ft)	$F_b S_{eff,90}$ (lb-ft/ft)	$EI_{eff,90}$ (10^6 lb-in²/ft)	$GA_{eff,90}$ (10^6 lb/ft)	$V_{s,90}$ (lb/ft)
1.4V[c]	CLT3-082	3.24	1,250	46	0.36	1,170	95	1.5	0.41	390
	CLT3-90	3.54	1,500	60	0.39	1,276	116	2.0	0.44	425
	CLT3-090T	3.54	1,460	59	0.37	1,270	160	3.2	0.51	495
	CLT3-097	3.84	1,790	78	0.45	1,380	95	1.5	0.42	390
	CLT3-100	3.94	1,870	83	0.45	1,420	116	2.0	0.45	425
	CLT3-105	4.14	2,050	96	0.46	1,490	160	3.2	0.52	495
	CLT5-137	5.40	2,875	176	0.72	1,940	845	39	0.81	1,170
	CLT5-150	5.91	3,450	229	0.78	2,120	1009	51	0.89	1,270
	CLT5-152T	6.00	3,350	227	0.74	2,160	1,200	66	1.00	1,380
	CLT5-160	6.30	4,125	293	0.91	2,270	985	50	0.84	1,270
	CLT5-175	6.90	4,700	367	0.92	2,480	1,380	82	1.00	1,490
	CLT7-222	8.76	7,300	723	1.40	3,150	2,260	195	1.30	2,160
	CLT7-245	9.66	8,325	908	1.40	3,475	3,175	315	1.60	2,480
	CLT9-285	11.22	11,350	1,437	1.80	4,050	4,000	486	1.70	3,050
	CLT9-315	12.42	12,900	1,810	1.80	4,475	5,625	782	2.10	3,475
1.8M[d]	CLT3-097	3.84	4,300	100	0.46	1,380	95	1.5	0.53	430
	CLT3-105	4.14	4,925	123	0.47	1,490	160	3.2	0.65	550
	CLT5-160	6.30	9,875	377	0.93	2,270	985	50	1.10	1,420
	CLT5-175	6.90	11,275	471	0.93	2,480	1,380	82	1.30	1,660

For SI: 1 in. = 25.4 mm; 1 ft = 304.8 mm; 1 lbf = 4.448N

[a] Tabulated values are allowable design values and not permitted to be increased for the flat use or size adjustment factor in accordance with the NDS.

[b] Tabulated values are based on the shear-analogy model as defined in PRG 320-2019 Appendix X3.

[c] 1.4V grade design values are approved for SPF and DF-L laminations. Major strength direction laminations for each species group shall be visually- and/or electronically-graded lamstock with design values that equal or exceed the 1.4V design values in Table 1.

[d] 1.8M grade design values are approved for SPF and DF-L laminations. Major strength direction laminations for each species group shall be electronically-graded lamstock with design values that equal or exceed the 1.8M design values in Table 1.

TABLE 3

ASD Edgewise Design Values for Mercer CLT 1.4V Grade Panels

CLT Grade	No. of Layers	CLT Layup Designation	CLT Thickness, t_p (in)	Edgewise Shear Stress[a][b]	
				$F_{v,e,0}$ (psi)	$F_{v,e,90}$ (psi)
1.4V	3-ply	CLT3-082	3.24	190	215
		CLT3-90	3.54	190[c]	215[c]
		CLT3-090T	3.54	190[c]	215[c]
		CLT3-097	3.84	190[c]	215[c]
		CLT3-100	3.94	190[c]	215[c]
		CLT3-105	4.14	190[c]	215[c]
	5-ply	CLT5-137	5.40	240	235
		CLT5-150	5.91	240[d]	235[d]
		CLT5-152T	6.00	240[d]	235[d]
		CLT5-160	6.30	240[d]	235[d]
		CLT5-175	6.90	240[d]	235[d]
	7-ply	CLT7-222	8.76	240[d]	235[d]
		CLT7-245	9.66	240[d]	235[d]
	9-ply	CLT9-285	11.22	240[d]	235[d]
		CLT9-315	12.42	240[d]	235[d]

For SI: 1 in. = 25.4 mm; 1 ft = 304.8 mm; 1 lbf = 4.448N

[a] Tabulated values shall be multiplied by the gross cross section area (in.^{2}) of the CLT element under consideration to attain the ASD edgewise shear strength (lbf).

[b] Values are applicable for 1.4V and better CLT Grades.

[c] Based on test results for CLT3-082

[d] Based on test results for CLT5-187

Mercer Mass Timber

Spokane Mass Timber Factory

19202 East Garland Avenue
Spokane Valley, WA 99027
United States

Design + Structural Engineering

Suite 1120, 700 West Pender Street
Vancouver, BC, V6C 1G8
Canada

clt@mercerint.com
mercermasstimber.com