Prepared by **TimberLogic LLC** *for:*
Coventry Log Homes, Inc.
108 South Court Street, Woodsville, NH 03785
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6x8D: 6x8 (Nominal) Tongue & Groove (T&G) D-Shape Wall-Log

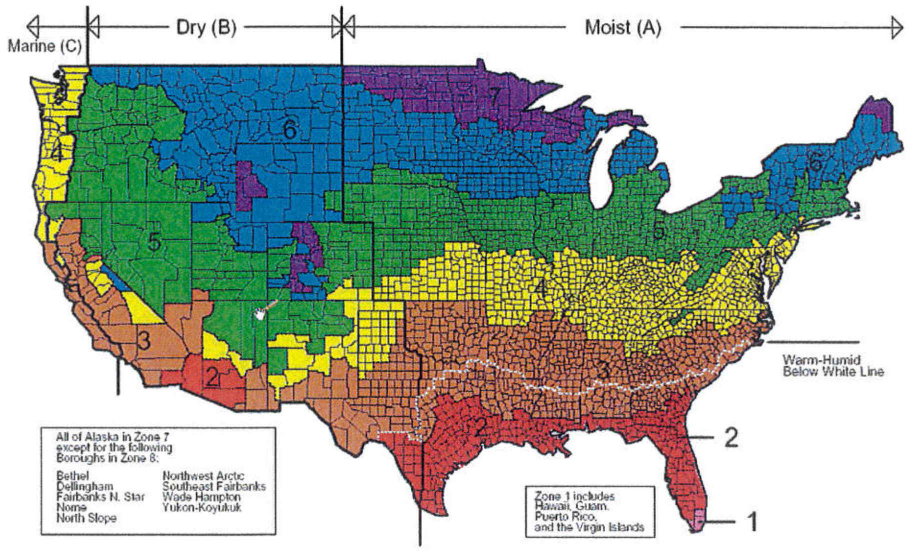
Inscribed Rectangle: 4.95"x 6.75" ***Pine: Eastern white (EWP)***

Physical Properties of Wall-Logs

2.4 Calculation of Log Characteristics Relating to Moisture Content:

*Calculated using methods described in FPL-RN-0268, *Equilibrium Moisture Content of Woods in Outdoor Locations in the United States and Worldwide*, William T. Simpson, Aug. 1998, as related to the US DOE climate zone map in the IECC. Equations per Wood Handbook, FPL.

Fig. 4 Climate zone map, 2005 ICC International Energy Conservation Code (US DOE).



2.41 Hygroscopic Properties:

MC_{FSP}	moisture content at fiber saturation					30	%
M_I	moisture content at time of milling					19	%
	Shrinkage coefficients are per Table 3-5 Wood Handbook: Shrinkage (%)			radial	tangential	volumetric	
S	*from green to oven dry moisture content*			2.1	6.1	8.2	
Gb	specific gravity based on green volume (ASTM D2555)					0.35	
Anticipated Equilibrium Moisture Contents (EMC) by Climate Zone*	Climate Zone (ref. Fig.4)	**Initial**	**Dry**	**Moist**	**Warm-Humid**	**Marine**	
	Indoor		6	8	11	11	%
	Exterior Minimum		8	12	13	13	%
MC_D	19% MC Maximum		13	15	15	17	%
MCs	Service Moisture Content = EMC Average	12	10	13	14	15	%
Gm	Wood Handbook Eq. 3-5: Gb/(1-.(0.265*a*Gb))	where a= (MC_{FSP}-EMC)/MC_{FSP}					
G	Specific Gravity at Exterior EMC	0.362	0.373	0.369	0.368	0.367	

2.42 Calculation of Log Weight:

	Density at MC_D	25.31	24.77	24.94	25.02	25.09	pcf
	ICC400 302.2.3.7: Density (lb/ft3) = 62.4 * [G/(1+(0.009*G*MC_S))] *(1+MC_S/100)						
w	Wall mass weight = density * Wa/12	10.91	10.68	10.75	10.78	10.81	psf
	Log weight Density x A/144	6.65	6.51	6.55	6.58	6.59	plf
	Density	25.31	24.77	24.94	25.02	25.09	pcf
Ww	Weight of log wall 13 courses typ.	86.45	84.63	85.15	85.54	85.67	plf

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Physical Properties of Wall-Logs

2.43 Calculation of Thermal Properties:

Climate Zone (ref. 4) RESCheck(R) nominal width = 6-in.

	Coefficients A, B and C are based on SG >0.3, design temperature at 75°F, and MC <25%:	Initial	Dry	Moist	Warm-Humid	Marine	
k	Wood Handbook Eq.3-7: thermal transmittance	0.806664	0.73326	0.757776	0.766376	0.77492	Btu in /
	Gm[B+ C(EMC)] +A *A=* 0.129		*B=* 1.34		*C=* 0.028		$(h\,ft^2\,°F)$
R	thermal resistance = 1/k	1.24	1.364	1.32	1.305	1.29	R/in.
R_L	Avg. Log Thickness x R-value/inch	6.41	7.05	6.83	6.75	6.67	
R_S	Logs bear on one another						
Rw	0.17 outside air film+R_L+0.68 inside air film	7.26	7.9	7.68	7.6	7.52	
Uw	u-value of wall assembly (1/Rw)	0.138	0.127	0.130	0.132	0.133	
t	degrees Fahrenheit	65	65	65	65	65	
c_{p0}	WH Eq.3-8b: $0.2605+0.0005132t$, for EMC=0.	0.294	0.294	0.294	0.294	0.294	
A_c	Eq.3-10: $MCs(b_1+b_2t+b_3MCs)$	0.019	0.013	0.016	0.016	0.017	
	b_1= -4.23x10^{-4}, b_2= 3.12x10^{-5}, b_3= -3.17x10^{-5}						
c_p	WH Eq.3-9: $c_{pw} = 1$ Specific heat	0.42	0.37	0.39	0.39	0.4	Btu/lb-°F
	$(c_{p0}+0.01MCs*c_{pw})/(1+0.01MCs)+A_c$, for EMC>0.						
HC	Heat Capacity (w,psf x c_p)	4.58	3.95	4.19	4.2	4.32	Btu/ft²-°F
	2003 IECC compliance for thermal mass	No	No	No	No	No	

2.5 Settling Properties for Wall-Logs:

- In this analysis, the verifiable (repeatable) measurement of wall settling has been found to be significant to 1/16" or 1 mm.

2.51 Estimated Total Settling:

		EMC Nat'l. Avg.	Dry	Moist	Hot-Humid	Marine	
Δs	**Ref. 2.52** Estimated settling due to shrinkage	-0.036	-0.047	-0.031	-0.026	-0.021	in.
Δc	**Ref. 2.53** Estimated settling due to compaction			NA			in.
Δ_{SL}	**Ref. 2.54** Estimated settling due to slumping	NA	NA	NA	NA	NA	in.
	Total estimated settling per log course	-0.036	-0.047	-0.031	-0.026	-0.021	in.
82.5	Above door (height, in.) with 2x buck above	7/16"	1/2 "	5/16"	5/16"	1/4 "	in.
N	13 courses Theoretical wall height			7 ft - 11 in			
	Estimated total settling for typical wall	-0.4375	-0.625	-0.375	-0.3125	-0.25	in.
	Percentage of final to initial log height:	0.5	0.6	0.4	0.4	0.3	%
MCs	Service Moisture Content = EMC	12	10	13	14	15	%
MC_D	For nonsettlnig, MC at time of millng needs to be:	**19% MC**	**18% MC**	**19% MC**	**19% MC**	**19% MC**	

2.52 Calculation of Dimensional Change Due to Seasoning (Ds, inches):

- Boxed heart timbers experience primarily radial shrinkage.

Δs	ICC400 304.2.2.3.4: $(H_L*(MC_D-MC_S))/(MC_{FSP}*100/S - MC_{FSP} + MC_D)$; H_L = stack height						
S_R	2.1% Radial change	-0.036	-0.047	-0.031	-0.026	-0.021	in.
	log stack height after seasoning to EMC	7.2765	7.2655	7.2815	7.2865	7.2915	in.
S_V	8.2% Volumetric change	-0.147	-0.19	-0.126	-0.105	-0.083	
	Shrinkage coefficients are per Table 3-5 Wood Handbook: Shrinkage (%) from green to oven dry moisture content						
	0.1 Longitudinal shrinkage coefficient		0.144 in.	per mean log length of		12	ft.

2.53 Calculation of Compression in Exterior Wall due to Gravity Loads

Fc, perp.	design stress value for compression perpendicular to grain	350	psi
CL	Compression load from weight of walls + floor + roof	880	plf
	Required bearing width (load imposed on a log course/12 = lbs./in.; /Fc^ = min. width) =	7/32	in.
B_{LP}	Width of log-to-log bearing	3	in.
	Fc,perp. (psi) x log bearing (in.) x 12 Max. Log bearing capacity =	12600	plf

Ref. 3.4

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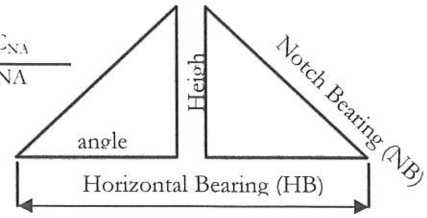
Physical Properties of Wall-Logs

2.531 Calculation of compaction for notched/coped profiles:

Assumes compaction occurs until sufficient bearing area, normalized to the angle of the notch, is

	HB/2	H	Angle A	CosA	SinA	NB	C_{NA}
Cope/notch:	NA	NA	NA	NA	NA	NA	NA
Log:	NA	NA	NA	NA	NA	NA	in.
Min. bearing:	1.5	NA	0	NA	NA	NA	



Settling potential due to notch/cope:	NA	in. per course
Settling potential due to bearing width:	NA	in. per course
Initial joint - settling due to compaction =	NA	in. per course

2.54 Calculation of Settlement Due to Slumping:

Tests for Slumping Analysis: <u>*Test for slump not required.*</u>

Does the profile provide continuous contact or have horizontal bearing surfaces?	Yes
Is the moisture content at profiling greater than that in service?	Yes
Is a seasoning kerf cut opposite of the cope?	No
Is the kerf depth + the cope height >/= (log height/4)?	NA
Is the kerf depth + cope height > distance between the kerf and cope?	NA
Does $MC_D = MC_{FSP}$?	No
Is the cope width > log diameter x 3/8?	NA
Is the cope height/depth > log height/4?	NA

No settling due to slumping is estimated.

2.541 Calculating Slump:

Slump, per course = Height of void between logs x the slumping coefficient

H_{CA}	Height of void in groove 3/16"	less settling due to compression			NA		0	in.
Wc	width of cope						1.5625	in.
p	log circumference = PI x diameter =						NA	in.
		12% EMC	Dry	Moist	Hot-Humid		Marine	
MC_D	For nonsettlnig, MC at time of millng needs to be:	19% MC	18% MC	19% MC	19% MC		19% MC	
S_T	6.1% Tangential change	NA	NA	NA	NA		NA	in.
	$(p^*(MC_S - MC_D))/((MC_{FSP}^*100/S - MC_{FSP}) + MC_D)$							
C_{SL}	Slumping Factor D/ (p - Wc - ST)	NA	NA	NA	NA		NA	
Δs	$H_{CA} * N * C_{SL}$ Per log course:	NA	NA	NA	NA		NA	in.

2.6 Joint Design

2.61 Horizontal Joint:

	Sealant compression	Compres-sion Force	
Test results reported by mfr.	10%	0 psi	Recovery Rate
	25%	1 psi	-500%
	50%	1 psi	
	65%	1 psi	A fastening force of 3 plf is required to compress sealant.
	75%	1 psi	

Joint dimensions	Width	Height	
Sealant (All-Weather Foam):	0.75	0.5	in.
Top/tongue:	1.5625	0.375	in.
Bottom/groove:	1.5625	0.5625	in.
Initial Joint:		0.1875	in.
Initial sealant compression:		62.50%	%
Fastening force required initially to		1	psi
compress gasket:		9	plf

EMC Nat'l. Avg.	Dry	Moist	Hot-Humid	Marine	
In service joint: 0.2235	0.2345	0.2185	0.2135	0.2085	in.
In service sealant compression: 55.30%	53.10%	56.30%	57.30%	58.30%	%

Horizontal joint design tolerance in service (worst case, Dry climate), 2 x [radial shrinkage+slumping-compaction]: 0.09375 in.

Std. log fastener: LogHog x 11-in. at 24-in. o/c.

Fastening schedule to initially compress gasket: 24 in. o/c

2.62 Vertical Joint:

Head of fastener to be set below log surface no less than 1/16 in.

Vertical joint design tolerance for longitudinal shrinkage for Splined butt joints. 9/32 in.

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