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NH DEPARTMENT OF SAFETY
NH STATE FIRE MARSHAL'S OFFICE

NEW HAMPSHIRE STATE BUILDING CODE PROPOSED AMENDMENT

Proposed amendment submitted by:

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Company/Jurisdiction: Home Builders and Remodelers Association of NH

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Applicable code(s): IBC IRC IPC IMC IECC NFPA 70
(circle applicable code)

Current Code language (including section numbers):

IRC2009 Section N1101.2 Compliance. Compliance shall be demonstrated by either meeting the requirements of the *International Energy Conservation Code* or meeting the requirements of this chapter. Climate zones from Figure N1101.2 or Table N1101.2 shall be used in determining the applicable requirements from this chapter.

IECC2009 Section 101.5 Compliance. *Residential buildings* shall meet the provisions of chapter 4. *Commercial buildings* shall meet the provisions of chapter 5.

Proposed code language:

IRC2009 Section N1101.2 Compliance. Compliance shall be demonstrated by either meeting the requirements of the *International Energy Conservation Code*, **meeting the requirements of Section 305 of the *ICC-400 2012 Standard on the Design and Construction of Log Structures*** or meeting the requirements of this chapter. Climate zones from Figure N1101.2 or Table N1101.2 shall be used in determining the applicable requirements from this chapter.

IECC2009 Section 101.5 Compliance. *Residential buildings* shall meet the provisions of chapter 4. *Commercial buildings* shall meet the provisions of chapter 5. **Log structures shall meet the provisions of Section 305 of the *ICC-400 2012 Standard on the Design and Construction of Log Structures.***

Reason/justification:

This amendment will establish an alternate compliance path for the thermal envelope requirements for log homes in NH. It is necessary because the IECC does not properly

apply to log homes and the ICC-400 Standard is the recognized alternative to the IECC for log structures.

Financial Analysis:

The impact of this amendment will not adversely affect the cost of log home construction and will prevent a dramatic increase in the cost of new log homes. The amendment will have no adverse financial impact on the state, local jurisdictions or its citizens.

Code Board Action: Date: _____

Approved:_____ Approved with modifications:_____ Not approved:_____
Modifications:

Exhibit # _____

TABLE 305.3.1.1
U-Factor of Log Wall (U_w) by Average Width (W_L) and Specific Gravity

Specific Gravity (Gu)	Average Width											
	5 in.	6 in.	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	14 in.	15 in.	16 in.	18 in.
0.29	0.114	0.097	0.084	0.074	0.067	0.060	0.055	0.051	0.044	0.041	0.038	0.034
0.30	0.117	0.099	0.086	0.076	0.068	0.062	0.057	0.052	0.045	0.042	0.040	0.035
0.31	0.120	0.102	0.089	0.078	0.070	0.064	0.058	0.053	0.046	0.043	0.041	0.036
0.32	0.123	0.104	0.091	0.080	0.072	0.065	0.060	0.055	0.047	0.044	0.042	0.037
0.33	0.126	0.107	0.093	0.082	0.074	0.067	0.061	0.056	0.049	0.046	0.043	0.038
0.34	0.129	0.109	0.095	0.084	0.076	0.068	0.063	0.058	0.050	0.047	0.044	0.039
0.35	0.132	0.112	0.097	0.086	0.077	0.070	0.064	0.059	0.051	0.048	0.045	0.040
0.36	0.135	0.115	0.100	0.088	0.079	0.072	0.066	0.060	0.052	0.049	0.046	0.041
0.37	0.137	0.117	0.102	0.090	0.081	0.073	0.067	0.062	0.053	0.050	0.047	0.042
0.38	0.140	0.120	0.104	0.092	0.083	0.075	0.069	0.063	0.055	0.051	0.048	0.043
0.39	0.143	0.122	0.106	0.094	0.085	0.077	0.070	0.065	0.056	0.052	0.049	0.044
0.40	0.146	0.125	0.109	0.096	0.086	0.078	0.072	0.066	0.057	0.054	0.050	0.045
0.41	0.149	0.127	0.111	0.098	0.088	0.080	0.073	0.067	0.058	0.055	0.051	0.046
0.42	0.152	0.129	0.113	0.100	0.090	0.082	0.075	0.069	0.060	0.056	0.053	0.047
0.43	0.155	0.132	0.115	0.102	0.092	0.083	0.076	0.070	0.061	0.057	0.054	0.048
0.45	0.160	0.137	0.120	0.106	0.095	0.087	0.079	0.073	0.063	0.059	0.056	0.050
0.46	0.163	0.139	0.122	0.108	0.097	0.088	0.081	0.075	0.065	0.060	0.057	0.051
0.47	0.166	0.142	0.124	0.110	0.099	0.090	0.082	0.076	0.066	0.062	0.058	0.052
0.48	0.169	0.144	0.126	0.112	0.101	0.091	0.084	0.077	0.067	0.063	0.059	0.053
0.49	0.171	0.147	0.128	0.114	0.102	0.093	0.085	0.079	0.068	0.064	0.060	0.054
0.51	0.177	0.152	0.133	0.118	0.106	0.096	0.088	0.082	0.071	0.066	0.062	0.056
0.53	0.182	0.157	0.137	0.122	0.110	0.100	0.091	0.084	0.073	0.069	0.065	0.058
0.54	0.185	0.159	0.139	0.124	0.111	0.101	0.093	0.086	0.074	0.070	0.066	0.059
0.55	0.188	0.161	0.141	0.126	0.113	0.103	0.094	0.087	0.076	0.071	0.067	0.060
0.56	0.191	0.164	0.144	0.128	0.115	0.105	0.096	0.089	0.077	0.072	0.068	0.061
0.57	0.193	0.166	0.146	0.130	0.117	0.106	0.098	0.090	0.078	0.073	0.069	0.062
0.62	0.207	0.178	0.156	0.139	0.126	0.115	0.105	0.097	0.084	0.079	0.075	0.067
0.70	0.228	0.197	0.174	0.155	0.140	0.128	0.117	0.109	0.094	0.089	0.084	0.075

TABLE 305.3.1.2
INSULATON AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	LOG WALL, W_L [h]	FENESTRATION U-FACTOR [b]	SKYLIGHT U-FACTOR [b]	FENESTRATION SHGC[b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [c]	FLOOR R-VALUE [d, e]	BASEMENT [f] / CRAWL WALL R-VALUE	SLAB R-VALUE & DEPTH	HEATED SLAB R-VALUE [g]
1	5" min.	0.50	0.75	0.25	30	13	13	0	0	5
2	5" min.	0.40	0.65	0.25	38	13	13	0	0	5
3	5" min.	0.35	0.55	0.25	38	20 or 13+5	19	5/13	5, 2-ft.	5
4 & MARINE	5" min.	0.33	0.55	0.40	49	20 or 13+5	19	10/13	10, 2-ft.	10
5 EXCEPT MARINE	5" SG?0.50; 7" SG>0.50	0.32	0.55	NR	49	20 or 13+5	30	15/19	10, 2-ft.	10
6		0.30	0.55	NR	49	20 or 13+5	30	15/19	15, 4-ft.	15
7 & 8		0.30	0.55	NR	49	20+5 or 13+10	38	15/19	15, 4-ft.	15

For SI: 1 foot = 304.8 mm.

Notes to Table 305.3.1.2

a. R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table.

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1-3, where the SHGC for such skylights does not exceed 0.30.

c. "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

d. Or insulation sufficient to fill the framing cavity, with R-19 as the absolute minimum in Climate Zones 5-8.

e. Insulate perimeter of floor system to match floor R-value requirement with basement/crawl foundations.

f. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-10 continuous insulation on the interior or exterior of the home.

g. The required insulation shall be installed beneath the entire slab for heated slabs.

h. W_L is the average wall-log width. Nominal callouts will be larger (e.g., a 5" log would be 6x or 7" diameter; a 7" would be 8x or 9" diameter). SG = specific gravity.

304.3.7.1 Flexible connections. Plumbing and ductwork running vertically through a floor, ceiling, or roof shall be equipped with flexible connections sufficient to accommodate the involved settling height. Wiring shall have sufficient slack or be provided with sufficient extra space to accommodate the involved settling height.

304.3.7.2 Pipes through log walls. A plumbing pipe shall only travel through a log wall perpendicular to the long horizontal axis of the logs, shall be level or nearly level, and shall be fitted with flexible connections at each end or be provided with a sufficient settling gap to accommodate the involved setting height.

304.3.7.3 Electrical Wires Within Log Walls. The maximum number of electrical conductors allowed in an electrical chase bored in a log wall shall be the same as allowed in similarly sized conduit as specified in the applicable electrical code.

SECTION 305
THERMAL ENVELOPE

305.1 Weather protection. Exterior walls shall comply with the applicable code and the provisions of this section.

305. 1.1 Joint design. Joint design and applied sealants shall be capable of maintaining the weather seal between logs in exterior walls as individual logs reach equilibrium moisture content.

305.1.2 Moisture control and air leakage. The design shall resist air and moisture infiltration.

305.1.3 Extreme conditions. Where the effects of wind due to exposure (Exposure C or D) or topography (wind speed-up effect) exist, the exterior joint design shall be calculated on the lower extent of the MC_S range for the climate zone in accordance with Table 304.2.4.

305.1.4 Kerfs. Kerfs shall be protected from weather by being fully covered by the joint pattern of the log above (e.g., cope, tongue and groove), or by a notch or sealant.

305.1.5 Documentation. Assembly instructions for joints located on the exterior of a wall shall be detailed in the required construction documents.

305.1.6 Sealant. Sealant materials shall be applied in accordance with sealant manufacturer recommendations, and instructions. Sealant materials shall be compatible with all materials in contact with the sealant.

305.2 Procedural requirements. Buildings shall comply with the requirements of the *International Energy Conservation Code.*

Exception: Buildings that comply with Section 305.3 of this Standard need not comply with the requirements of IECC Section 402.1.

305.3 Thermal properties of log walls. Thermal properties of log walls shall be determined in accordance with the methods provided in Section 305.3.1, 305.3.2 or 305.3.3.

305.3.1 Prescribed method. The prescribed method shall be in accordance with Section 305.3.1.1 or 305.3.1.2.

305.3.1.1 U-Factor. The U-Factor (Uw) of the opaque log wall assembly shall be selected from Table 305.3.1.1.

305.3.1.2 Thermal envelope. The thermal envelope shall be compliant with the requirements of Table 305.3.1.2 and this section.

305.3.2 Test method. Physical testing of thermal conductance shall be in accordance with ASTM C 177, ASTM C 236, or ASTM C 518.

305.3.3 Calculation method. Calculate the Coefficient of Transmission (u) of the log wall using the equation:

$U =$ 1/(inside air film + Ro + outside air film)

where:

Inside Air Film = An R-value of 0.68 for still air at a vertical surface and horizontal heat flow.

Outside Air Film = An R-value of 0.17 for a 15 mph (6.6 m/s) wind moving air in any direction during the winter.

$Ro = [(A_L \times R_L) + (A_N \times R_N)] / A_T$ = The overall R-value of the wall assembly found by weighted average of areas of the assembly for respective variations in the cross-section of the wall. If the entire wall assembly consists only of logs, $Ro = R_L$.

where:

$A_L = L_T \times (IR_h\ C) / H_o$ = The percentage of the wall that consists of log.

$A_N = L_T \times (H_N\ C) / H_o$ = The percentage of the wall that is other than log.

where:

$L_T =$ The length of a wall using the dimension for the interior face of exposed wall.

$IR_h =$ The height of the inscribed rectangle.

$H_N =$ The height of the cross-section that is not log.

C = The number of courses that constitute the vertical wall dimension.

$H_o =$ The overall height of the finished wall.

$AT =$ The total wall area.

$R_L = W_L / k$

where:

$WL =$ The average thickness of the log at time of manufacture.

k = Btu·in/(h·ft2·F) = $G\,[B + C\,(MC_S)] + A$

$G =$ Specific gravity.

$MCs =$ The service moisture content.

$A =$ 0.129, $B = 1.34$, and $C = 0.028$; the constants A, B, and C represent specific gravity greater than 0.30, design temperature at 75°F, (17°C) and moisture content less than 25 percent.

$R_N =$ The sum of the R-values of the components that constitute the nonwood cross-section of the wall.

TABLE 305.4.1.3
HEAT CAPACITY OF SOLID WOOD

Temperature			Specific heat [(kJ/kg K(Btu/lb F))]			
(K)	C	F	Ovendry	5% MC	12% MC	20% MC
280	7	45	1.2 (0.28)	1.3 (0.32)	1.5 (0.37)	1.7 (0.41)
290	17	75	1.2 (0.29)	1.4 (0.33)	1.6 (0.38)	1.8 (0.43)
300	27	80	1.3 (0.30)	1.4 (0.34)	1.7 (0.40)	1.9 (0.45)
320	47	116	1.3 (0.32)	1.5 (0.37)	1.8 (0.43)	2.0 (0.49)
340	67	152	1.4 (0.34)	1.6 (0.39)	1.9 (0.46)	2.2 (0.52)
360	87	188	1.5 (0.36)	1.7 (0.41)	2.0 (0.49)	2.3 (0.56)

305.4 Thermal mass effect of log walls. The thermal mass benefit of log walls shall be determined in accordance with this section.

305.4.1 Prescribed method. Log walls shall be evaluated as mass walls in accordance with Section 402.2.4 of the International Energy Conservation Code.

305.4.2 Test method. Physical testing of the thermal mass shall be in accordance with ASTM C 976.

305.4.3 Calculation method for computer modeling.

305.4.3.1 Weight of wall. Calculate the weight of the wall in pounds per square foot (psf) using the density equation in Section 302.2.3.7.

305.4.3.2 Heat capacity. Calculate the heat capacity for the thermal mass provision using the following.

$$HC = w \times c$$

where:

HC = Heat capacity of the exterior wall, Btu/ft2×°F [kJ/(m2×K)] of exterior wall area.

w = Mass of the exterior wall, lb/ft2 (kg/m2) of exterior wall area is the density of the exterior wall material, lb/ft3 (kg/m3) multiplied by the thickness of the exterior wall calculated in accordance with section 302.2.3.6.

c = Specific heat of the exterior wall material, Btu/lb×°F [kJ/(kg×K)] of exterior wall area as determined from Table 305.4.1.3. The moisture content references in Table 305.4.1.3 shall be selected to be less than or equal to MCS.

305.4.2.2 Determine the mass Uw. Referring to IECC Table 502.2.1.1.2(3), select the column by matching the Uwdetermined in Section 305.4.2.1 to those heading the columns. Select the row according to the design heating degree days. Where the column and row cross provides the Uw with thermal mass effect.

SECTION 306
INFILTRATION

306.1 Log Walls. Log walls shall comply with this Section.

306.1.1 Air Leakage. The building thermal envelope shall comply with Sections 306.1.1.1 through 306.1.1.4.

306.1.1.1 Thermal envelope. Joint design and any applied sealants shall be capable of maintaining the weather seal at penetrations of the thermal envelope. Such penetrations shall include, but not be limited to, components passing through or over exterior log walls.

306.1.1.1.1 Patterned Sheathing and/or decking penetrating or passing over log walls. Methods shall be employed to restrict air flow between interior and exterior where patterned sheathing/decking (e.g., tongue and groove decking with v-groove pattern exposed to view) connections penetrate to the exterior of the building envelope.

306.1.1.2 Patterned sheathing and/or decking seams at ceiling areas. Methods shall be employed to restrict air flow and moisture migration through the joined edges of patterned sheathing/decking.

306.1.1.3 Structural components passing over or through log walls. Where structural roof or floor members pass beyond the weather protection provided by the joint design, the penetration shall be capable of maintaining the weather seal between wall and structural members as the logs reach equilibrium moisture content.

306.1.1.4 Wall Openings. Rough openings in walls shall be designed and constructed to protect the opening from air and water infiltration as well as accommodate settling.

306.2 Moisture Protection. The exterior water plane shall effectively shed water from precipitation and shall comly with Sections 306.2.1 through 306.2.4.

306.2.1 Water plane. The exterior water plane is formed by the contiguous log surfaces on which a water film may form extending to the point of weather protection provided by joint design in accordance with Section 305.1.

306.2.2 Water collection. Wall surfaces shall be designed and constructed to promote positive drain of water to exterior to eliminate potential for collection of moisture on or in the log wall.