RE-16

R402.1 (IRC N1102.1)

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2015 International Energy Conservation Code

R402.1 (N1102.1) General (Prescriptive). The *building thermal envelope* shall meet the requirements of Sections R402.1.1 through R402.1.5.

Exceptions:

~~**Exception:**~~1. The following low-energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h • ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 of floor area for space-conditioning purposes.
2. Those that do not contain *conditioned space*.

2. Log homes designed in accordance with ICC-400.

Reason: This amendment refers design of log homes to ICC400 *Standard on the Design and Construction of Log Structures* (ICC400) as it is the only consensus standard for log building. This amendment would benefit future state and local adoption as it is consistent with existing State amendments or legislation. At least four states have passed legislation referring to ICC400, while several other states have amended their energy conservation code to add log home specific paths. In 2015, the City and County of Denver adopted language similar to the proposed, and Vermont amended the 2015 IECC to add Table 402.1.5, *Log Home Insulation, Fenestration and Heating Requirements by Component*. Idaho added Table R402.a *Log Home Prescriptive Thermal Envelope Requirements by Component* to their 2014 code. Minnesota added Footnote H to Table 1102.1(1) to their 2012 IECC.
The design, construction and performance of log walls are quite different than the convention construction methods detailed in the IRC (and residential requirements of the IECC). ICC400 responds to the thermal envelope requirements of the IRC Chapter 11 and IECC Chapter 4. The standard offers prescriptive, calculated/engineered and performance/testing paths for substantiating the performance of log walls, and trade-off packages for each Climate Zone. Therefore, the thermal envelope of log homes would be evaluated as follows:

- **THERMAL:** ICC400-2012 **Section 305 Thermal Envelope** presents requirements for weather protection and determination of thermal properties, offering prescriptive, calculation, and performance options. **TABLE 305.3.1.2 Insulation and Fenestration Requirements by Component** provides one such prescriptive option.
- **AIR INFILTRATION:** Guidance is provided in ICC400 in **Section 306 Infiltration**. Section 306, along with 305.1 Weather protection and 304 Provisions for Settling in Log Structures all work in unison to address the issue. The same blower door requirement of the 2015 code shall apply to log walls as for any other method of construction.
- **VAPOR RETARDERS:** As noted in Exception 3 of IRC Section R702.7 Vapor retarders, "Construction where moisture or its freezing will not damage the materials." There is no cavity to protect in a log wall, and all joinery is covered by ICC400-2012.
- **EXTERIOR COVERING:** The Exception in IRC Section R703.1 General refers to "Log walls designed and constructed in accordance with the provisions of ICC400." The standard covers all discussion of weather resistance, drainage planes, etc.

The members of the Log & Timber Homes Council have encouraged certifying log homes through Energy Star® for many years. With the attention to design and construction details in accordance with ICC400, log homes with a nominal 6" wide log profile have been certified as 5-Star Plus with ratings in the 50's and lower. Blower door testing has demonstrated that log homes meet the 3ACH50 requirements of Climate Zones 4-8. These tests have

demonstrated that perhaps it is the tightness as well as mass of a log home that provide the satisfaction and comfort of the occupants.

It is important to note that ICC400 pertains to building solid wood walls and structural framing with logs. It defaults to the I-Codes for design conditions, foundations, roofing, mechanical, electrical, plumbing, etc. In Section 305 Thermal Envelope, ICC400 calls for compliance with the requirements of the IECC with an exception for log walls. The thermal properties of log walls can be taken from prescriptive tables, tested or calculated per the stipulated equations. Application of thermal mass is described to establish conformance with the IECC.

Bibliography: ***ICC Standard on the Design and Construction of Log Structures (ICC 400)***
Please note: ICC copyrighted documents can only be distributed through their publications department. Electronic and print copies can be obtained from the ICC store at http://shop.iccsafe.org/catalogsearch/result/?order=relevance&dir=desc&q=ICC+400.

Energy Performance of Log Homes, Log & Timber Homes Council, NAHB, 2015, 42 pgs. http://loghomes.org/wp-content/uploads/2013/06/EnergyPerformanceWP_2010.pdf

Preservation & Maintenance of Log Structures, Log & Timber Homes Council, NAHB, 2003, 16 pgs. http://loghomes.org/wp-content/uploads/2013/06/Preservation-Maintenance-of-Log-Structures-10-15-03.pdf

Cost Impact: Will not increase the cost of construction
Log wall construction is an alternate method of construction from the wood frame, steel frame, and concrete masonry options addressed in the energy conservation codes. The intent is to evaluate solid wood walls rather than apply prescriptive requirements that may impact the esthetic and/or durability of the wall system.
Without this change, readers may believe that they have only three options: 1.) Build with very large logs, 2.) Add insulation to the outside, or 3.) Add insulation to the inside.

> **Option 1:** Prescriptive mass wall R-values set minimum log widths that are not commonly available, require greater cost to build, and cannot be milled by equipment used today. These factors will constrict the industry to the high-end custom home market. It will cause the existing log home inventory significant undue stress as owners of otherwise energy efficient log homes will be pressed to insulate their nominal 6" log walls (average width of 5"-5.5"). A survey of the industry indicates that a 10" round/8x nominal or smaller covers 80% of the log home products built and in production in climate zones 5-8, which is over 55% of the log home market. The 10" round/8x nominal log size equates to an average log width of about 7"-7.5".
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> **Option 2:** This would be consistent with the details for cross-laminated timber (CLT).
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> **Option 3:** It should be noted that adding insulation to the inside of a log wall is not recommended as it restricts the benefits of mass wall effects while eliminating the opportunity for inspection that may otherwise identify a need for maintenance.

All three options are extremely costly as opposed to trade-offs in the building thermal envelope, which is why most log home companies use REScheck for compliance. This can help keep the log width to a size that is economical for production, builder and home owner. Therefore the cost of construction can actually be reduced by evaluating log walls by measures other than prescriptive wall R-value (R/inch of wood).

Effect of the proposed amendment on the cost of design: __ Increase __ Reduce XXX No Effect

Effect of the proposed amendment on the cost of construction: __ Increase XXX Reduce __ No Effect

Is the amendment proposal more or less restrictive than the I-Codes? __ More __ Less XXX Same