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Identification of Codes and Standards Issues

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Report - 0911

19 December 2009

Joseph Lstiburek

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Abstract:

BSC has been active for many years in working to help identify and address code and standards issues that are a barrier to the proper use of technologies and products in the design and construction of high efficiency homes."

1. IDENTIFICATION OF CODES AND STANDARDS ISSUES

1.1 Executive Summary

1.1.1. Identification of Codes and Standards Issues Overview

BSC has been active for many years in working to help identify and address code and standards issues that are a barrier to the proper use of technologies and products in the design and construction of high efficiency homes.

Code and Standards issues manifest in many forms from improper code interpretation or employment, missing code language, or incorrect code language. Similarly addressing these issues can take several forms.

1.1.2. Summary of Code Issues

Three specific building code issues were identified for action during this building code cycle applicable to the 2012 Model Building Codes.

Two proposed code changes were submitted for consideration relating to the International Residential Code (IRC) and one proposed code change was submitted for consideration relating to the International Building Code (IBC). The "reasoning statements" for each code change are referenced below and included in this section.

These code changes were viewed as the most significant requiring action - and also were viewed as the most likely to be successfully addressed. They are discussed below - including their current "adoption status."

1.2 Proposed International Residential Code Changes

1.2.1. RB 161

Modification of IRC Section 806.4 - relating to unvented attic assemblies. The documentation for this code change is referenced as "Appendix B.1.4.1_Lstiburek RB 161." This designation refers to the actual modification reference used in the Code Development Hearings that took place in Baltimore, MD, October 24 to November 11, 2009.

This code change affects the design and construction of high performance attic assemblies. The current language of the code does not explicitly allow for the construction of unvented cathedral ceilings. This is a major problem with all types of residential construction. And even more significant in the retrofit and rehabilitation of existing homes where it is not practical to construct vented roof assemblies.

The short term approach has been to obtain variance from the local building official on each and every project under architectural seal.

The permanent solution is a code change as submitted. This code change was approved by the IRC Committee. The next step is approval at the Final Action Hearings for the IRC in Austin this summer. This code change is expected to pass.

1.2.2. RB 104

Modification of IRC Section 602.7 - relating to single headers. The documentation for this code change is referenced as "Appendix B.1.4.2_Lstiburek RB 104". This designation refers to the actual modification reference used in the Code Development Hearings that took place in Baltimore, MD, October 24 to November 11, 2009.

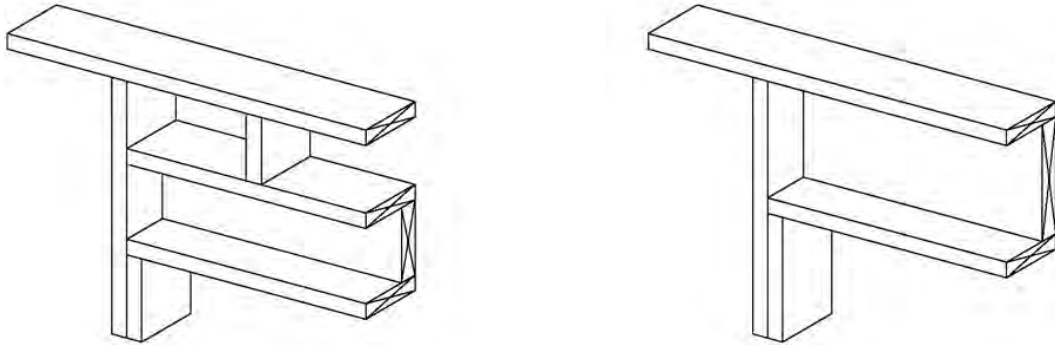


Figure 1.1: Single headers

This code change affects the design and construction of advanced frame single family residential houses. Almost all advanced frame construction details are already referenced in the IRC - except a provision for single headers. This absence has affected the construction of all advanced frame houses to date.

The short term approach has been to obtain variance from the local building official on each and every project under architectural seal.

The permanent solution is a code change as submitted. This code change was approved by the IRC Committee. The next step is approval at the Final Action Hearings for the IRC in Austin this summer. This code change is expected to pass.

1.3 Proposed International Building Code Change

1.3.1. G 144

Modification of IBC Section 806.4 - relating to unvented attic assemblies. The documentation for this code change is referenced as "Appendix B.1.4.3_Lstiburek G 144." This designation refers to the actual modification reference used in the Code Development Hearings that took place in Baltimore, MD, October 24 to November 11, 2009.

This code change affects the design and construction of high performance attic assemblies in multi-story multi-family construction. The current language of the code does not allow for the construction of unvented attics or cathedral ceilings. This is a major problem with these types of construction. And even more significant in the retrofit and rehabilitation of existing multi-unit structures where it is not practical to construct vented roof assemblies.

The short term approach has been to obtain variance from the local building official on each and every project under architectural seal.

The permanent solution is a code change as submitted. This code change was rejected by the IBC Committee. The rationale was that the language of the proposed code change was not clear. Despite the language proposed being identical to sections in the IRC that have been in effect since 2001.

The decision of the IBC Committed will be appealed during the Final Action Hearings scheduled for the fall of 2010 in Charlotte. A floor vote action will be presented. This code change is not expected to pass during this round. Significant education of the voting members of the Committee and the voting members of the ICC Congress are necessary for this code change to be successful.

1.4 Appendix

1.4.1. Lstiburek RB 161

1.4.2. Lstiburek RB 104

1.4.3. Lstiburek G 144



Lstiburek-RB-2-R806.4

PUBLIC CODE CHANGE PROPOSAL FORM FOR PUBLIC PROPOSALS IN THE INTERNATIONAL CODES

2009/2010 CODE DEVELOPMENT CYCLE
CLOSING DATE: All Proposals Must Be Received by June 1, 2009
 The 2009/2010 Code Development Hearings are tentatively scheduled for
 October 24-November 11, 2009, Baltimore, MD.

1)

Name: Joseph Lstiburek		Date: May 31, 2009	
Jurisdiction/Company: Building Science Corporation			
Submitted on Behalf of: Joseph Lstiburek			
Address: 68 Main Street			
City: Westford		State: MA	Zip Code: 01886
Phone: (978) 852-5232	Ext.	Fax:	
E-mail address: joe@buildingscience.com			

2) **Copyright Release: In accordance with Council Policy #28 Code Development, all Code Change Proposals, Floor Modifications and Public Comments are required to include a copyright release. A copy of the copyright release form is included at the end of this form. Please follow the directions on the form. This form as well as an alternative release form can also be downloaded from the ICC website at www.iccsafe.org. If you have previously executed the copyright release for this cycle, please check the box below:**

2009/2010 Cycle copyright release on file

3) Indicate appropriate International Code(s) associated with this Public Proposal – Please use Acronym: IRC

If you have also submitted a separate coordination change to another I-Code, please indicate the code: _____
 (See section below for list of names and acronyms for the International Codes).

4) **Be sure to format your proposal and include all information as indicated below and in the Code Change Proposal Instructions' section on Page 2 of this form.**

5) Proposals should be sent to the following offices via regular mail or email. An e-mail submittal is preferred, including an electronic version, in either WordPerfect or Word. The only formatting that is needed is **BOLDING, STRIKEOUT AND UNDERLINING**. Please do not provide additional formatting such as tabs, columns, etc., as this will be done by ICC. **REMOVE TRACKING CHANGES, AUTOMATIC NUMBERING, OR ANY OTHER ADVANCED FORMATTING TOOLS THAT ARE PROVIDED BY WORD, FROM FILES CONTAINING YOUR CODE CHANGE PROPOSAL THAT YOU SEND TO ICC.**

Please use a separate form (see page 3) for each proposal submitted. Note: All code changes received will receive an acknowledgment by approximately June 21, 2009. Please contact the ICC staff listed below if you do not receive an acknowledgment by June 21, 2009.

Please check here if separate graphic file provided. Graphic materials (Graphs, maps, drawings, charts, photographs, etc.) must be submitted as separate electronic files in .CDR, IA, TIF or .JPG format (300 DPI Minimum resolution; 600 DPI or more preferred) even though they may also be embedded in your Word or WordPerfect submittal.

Code

- IBC - International Building Code
- IEBC - International Existing Building Code
- IFC - International Fire Code
- IFGC - International Fuel Gas Code
- ICC PC - ICC Performance Code
- IPC - International Plumbing Code
- IPSDC - International Private Sewage Disposal Code
- IPMC - International Property Maintenance Code
- IWUIC - International Wildland-Urban Interface Code
- IZC - International Zoning Code

Send to:

International Code Council
 Chicago District Office
 Attn: Diane Schoonover
 4051 West Flossmoor Road
 Country Club Hills, IL 60478-5795
 Fax: 708/799-0320
codechanges@iccsafe.org

-
- IECC - International Energy Conservation Code
 - IMC - International Mechanical Code
 - IRC - International Residential Code

International Code Council
 Birmingham District Office
 Attn: Annette Sundberg
 900 Montclair Road
 Birmingham, AL 35213-1206
 Fax: 205/592-7001
codechangesbhm@iccsafe.org

CODE CHANGE PROPOSAL FORM

(See instructions on page 2)

Code: IRC –09/10 (IBC, IEBC, IECC, IFC, IFGC, IMC, IPC, IPSCDC, IPM, IRC, ICCPC, IWUIC, IZC)

Code Sections/Tables/Figures Proposed for Revision (3.3.2); Note: *If the proposal is for a new section, indicate (new).*

IRC 806.4

Proponent: Name/Company/Representing (3.3.1): (NOTE: DO NOT USE ACRONYMS FOR YOUR COMPANY OR ORGANIZATIONAL NAME)

Joseph Lstiburek, Building Science Corporation, self

Revise as follows:

IRC

R806.4 Unvented attic and unvented enclosed rafter assemblies. Unvented attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) and unvented enclosed rafter assemblies (spaces between ceilings that are applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members/rafters) shall be permitted if all the following conditions are met:

1. The unvented attic space is completely contained within the building thermal envelope.
2. No interior class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed rafter assembly.
3. no changes
4. In climate zones 5, 6, 7 and 8, any air-impermeable insulation shall be a class II vapor retarder or shall have a class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. no changes except add new note
5.4. If preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Reason:

The main reason for this-change is to allow unvented roof construction for both attics and cathedral ceilings. The current language does not explicitly allow unvented roof construction for cathedral ceilings. Attics and ceilings are similar – the governing physics are identical - so the requirements will work for both. The language defining cathedral ceilings comes directly from similar language in the IBC Section 1203.2.

When the changes to vapor retarder definitions were made in the previous two code change cycles this section was inadvertently not changed. This proposed change inserts the new terminology and the appropriate specific class of vapor retarder.

The new note 5.4 acknowledges that rigid insulation sheets do meet the material properties of air-impermeable insulation directly. However, they are an air-impermeable insulation if their edges are not sealed to provide a continuous plane of airtightness. This new note clarifies the use of rigid insulation sheets.

Cost Impact: This proposal will not raise the cost of construction.

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF



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Code Sections/Tables/Figures Proposed for Revision (3.3.2); Note: If the proposal is for a new section, indicate (new).

IRC 602.7

Proponent: Name/Company/Representing (3.3.1): (NOTE: DO NOT USE ACRONYMS FOR YOUR COMPANY OR ORGANIZATIONAL NAME)

Joseph Lstiburek, Building Science Corporation, self

Revise as follows:

R602.7 Headers. For header spans see Tables R502.5(1) and R502.5(2). Alternative header applications in accordance with this section shall be permitted.

R602.7.1 Single member headers in exterior bearing walls. Single member headers in exterior bearing walls shall be permitted in accordance with Table R602.7.1. Single headers shall be framed top and bottom with a flat-wise 2x member. To make up the remaining space, cripples should be installed above the header. Alternatively, the header can be sized to fill the space between the wall top plate and a flat-wise 2x member. The header assembly shall bear on a minimum of one jack stud at each end.

R602.7.2~~1~~ Wood structural panel box headers. Wood structural panel box headers shall be constructed in accordance with Figure R602.7.2 and Table R602.7.2.

R602.7.3~~2~~ Nonbearing walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch-by-4-inch (51 mm by 102 mm) member may be used as a header in interior or exterior nonbearing walls for openings up to 8 feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). For such nonbearing headers, no cripples or blocking are required above the header.

**TABLE R602.7.1
SPANS FOR MINIMUM No.2 GRADE SINGLE HEADER
FOR EXTERIOR BEARING WALLS^{a,b,c}**

SINGLE HEADERS SUPPORTING	SIZE	Wood Species	GROUND SNOW LOAD (psf)								
			≤ 20 ^d			30			50		
			Building Width (feet) ^e								
			20	28	36	20	28	36	20	28	36
Roof and Ceiling	2x8	Spruce-Pine-Fir	4-10	4-2	3-8	4-3	3-8	3-3	3-7	3-0	2-8
		Hem-Fir	5-1	4-4	3-10	4-6	3-10	3-5	3-9	3-2	2-10
		Douglas-Fir or Southern Pine	5-3	4-6	4-0	4-7	3-11	3-6	3-10	3-3	2-11
	2x10	Spruce-Pine-Fir	6-2	5-3	4-8	5-5	4-8	4-2	4-6	3-11	3-1
		Hem-Fir	6-6	5-6	4-11	5-8	4-11	4-4	4-9	4-1	3-7
		Douglas-Fir or Southern Pine	6-8	5-8	5-1	5-10	5-0	4-6	4-11	4-2	3-9
	2x12	Spruce-Pine-Fir	7-6	6-5	5-9	6-7	5-8	4-5	5-4	3-11	3-1
		Hem-Fir	7-10	6-9	6-0	6-11	5-11	5-3	5-9	4-8	3-8
		Douglas-Fir or Southern Pine	8-1	6-11	6-2	7-2	6-1	5-5	5-11	5-1	4-6
Roof, ceiling and one center-bearing floor	2x8	Spruce-Pine-Fir	3-10	3-3	2-11	3-9	3-3	2-11	3-5	2-11	2-7
		Hem-Fir	4-0	3-5	3-1	3-11	3-5	3-0	3-7	3-0	2-8
		Douglas-Fir or Southern Pine	4-1	3-7	3-2	4-1	3-6	3-1	3-8	3-2	2-9
	2x10	Spruce-Pine-Fir	4-11	4-2	3-8	4-10	4-1	3-6	4-4	3-7	2-10
		Hem-Fir	5-1	4-5	3-11	5-0	4-4	3-10	4-6	3-11	3-4
		Douglas-Fir or Southern Pine	5-3	4-6	4-1	5-2	4-5	4-0	4-8	4-0	3-7
	2x12	Spruce-Pine-Fir	5-8	4-2	3-4	5-5	4-0	3-6	4-9	3-6	2-10
		Hem-Fir	5-11	4-11	3-11	5-10	4-9	4-2	5-5	4-2	3-4
		Douglas-Fir or Southern Pine	6-1	5-3	4-8	6-0	5-2	4-10	5-7	4-10	4-3
Roof, ceiling and one clear span floor	2x8	Spruce-Pine-Fir	3-5	2-11	2-7	3-4	2-11	2-7	3-3	2-10	2-6
		Hem-Fir	3-7	3-1	2-9	3-6	3-0	2-8	3-5	2-11	2-7
		Douglas-Fir or Southern Pine	3-8	3-2	2-10	3-7	3-1	2-9	3-6	3-0	2-9
	2x10	Spruce-Pine-Fir	4-4	3-7	2-10	4-3	3-6	2-9	4-2	3-4	2-7
		Hem-Fir	4-7	3-11	3-5	4-6	3-10	3-3	4-4	3-9	3-1
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		Hem-Fir	5-6	4-3	3-5	5-6	4-2	3-3	5-4	3-11	3-1
		Douglas-Fir or Southern Pine	5-8	4-11	4-4	5-7	4-10	4-3	5-6	4-8	4-2

For SI: 1 inch=25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Table is based on a maximum roof-ceiling dead load of 15 psf.

c. The header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header in lieu of the required jack stud.

d. The 20 psf ground snow load condition shall apply only when the roof pitch is 9:12 or greater. In conditions where the ground snow load is 30 psf or less and the roof pitch is less than 9:12, use the 30 psf ground snow load condition.

e. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

Reason:

This proposal provides a means of implementing advanced, energy-saving wall construction practices for limited conditions where single headers can be used. Thus, insulation can be placed together with the single header to prevent heat loss through headers which otherwise create a thermal short-circuit in exterior walls. The table is evaluated in accordance with the NDS-2005 and ASCE 7-05 building loads. For ease-of-use, the table format is consistent with the principle header tables found in Chapter 5 of the code. The single header practice has been use successfully in thousands of homes since originally developed under the optimal value engineering “OVE” banner by the NAHB and HUD in the 1960’s and more recently under the HUD/PATH and DOE Build America programs.

Cost Impact: This proposal will not raise the cost of construction.

Public Hearing: Committee:	AS	AM	D
Assembly:	ASF	AMF	DF



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Indicate appropriate International Code(s) associated with this Public Proposal – Please use Acronym: IBC

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(See section below for list of names and acronyms for the International Codes).

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Attn: Annette Sundberg
900 Montclair Road
Birmingham, AL 35213-1206
Fax: 205/592-7001
codechangesbhm@iccsafe.org

CODE CHANGE PROPOSAL INSTRUCTIONS

Please provide all of the following items in your code change proposal (see form on page 3). Your proposal should be entered on page 3 as a separate file. However, please read the instructions provided below for each part of the code change proposal. The sections identified in parentheses are the applicable sections from CP #28 Code Development. The full procedures can be downloaded from www.iccsafe.org.

PROPOSAL FORMATTING:

Show the proposal (see form on page 3) using strikeout, underline format. At the beginning of each section, one of the following instruction lines are also needed:

- Revise as follows
- Add new text as follows
- Delete and substitute as follows
- Delete without substitution

The only formatting that is needed is **BOLDING, STRIKEOUT AND UNDERLINING**. Please do not provide additional formatting such as tabs, columns etc. as this will be done by ICC. **DO NOT USE THE TRACKING CHANGES OPTION, AUTOMATIC NUMBERING, OR ANY OTHER ADVANCED FORMATTING TOOLS PROVIDED BY WORD.**

SUPPORTING INFORMATION: (3.3.4 & 3.4)

The following items are required to be included in your proposal (see form on page 3):

1. The proponent shall clearly state the purpose of the proposed code change (e.g., clarify the Code; revise outdated material; substitute new or revised material for current provision of the Code; add new requirements to the Code; delete current requirements, etc.)
2. The proponent shall justify changing the current code provisions, stating why the proposal is superior to the current provisions of the Code. Proposals that add or delete requirements shall be supported by a logical explanation which clearly shows why the current Code provisions are inadequate or overly restrictive, specifies the shortcomings of the current Code provisions and explains how such proposals will improve the Code.
3. The proponent shall substantiate the proposed code change based on technical information and substantiation. Substantiation provided which is reviewed in accordance with Section 4.2 and determined as not germane to the technical issues addressed in the proposed code change shall be identified as such. The proponent shall be notified that the proposal is considered an incomplete proposal in accordance with Section 4.3, and the proposal shall be held until the deficiencies are corrected. The proponent shall have the right to appeal this action in accordance with the policy of the ICC Board. The burden of providing substantiating material lies with the proponent of the code change proposal. A minimum of two copies of all substantiating information shall be submitted.
4. The proponent shall submit a bibliography of any substantiating material submitted with the code change proposal. The bibliography shall be published with the code change and the proponent shall make the substantiating materials available for review at the appropriate ICC office and during the public hearing.

REFERENCED STANDARDS: (3.4 & 3.6)

List any new referenced standards that are proposed to be referenced in the code and provide a minimum of two copies. For ICC rules on referenced standards, see Section 3.6 of CP #28. Additional copies will be required for committee members. ICC staff will provide you with a mailing list for the appropriate committees.

COST IMPACT: (3.3.4.6)

The proponent shall indicate one of the following regarding the cost impact of the code change proposal:

- 1) The code change proposal will increase the cost of construction; or
- 2) The code change proposal will not increase the cost of construction.

This information will be included in the published code change proposal.

CODE CHANGE SUBMITTAL EXAMPLE

Code: IBC-09/10
705.1

Proponent: John Doe, P.E., Acme Building Corporation, Inc, representing himself

Revise as follows:

705.1 General. Each portion of a building separated by ~~one or more~~ a fire walls that ~~comply~~ complies with the provisions of ~~this section~~ Section 705 shall be considered a separate building.

Reason: A fire wall complying with Section 705 establishes the equivalent of separate buildings on either side of the fire wall. This proposal provides text that more succinctly states this purpose of a fire wall.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

CODE CHANGE PROPOSAL FORM

(See instructions on page 2)

Code: IBC –09/10 (IBC, IEBC, IECC, IFC, IFGC, IMC, IPC, IPSCDC, IPM, IRC, ICCPC, IWUIC, IZC)

Code Sections/Tables/Figures Proposed for Revision (3.3.2); Note: *If the proposal is for a new section, indicate (new).*

IBC 806.4

Proponent: Name/Company/Representing (3.3.1): (NOTE: DO NOT USE ACRONYMS FOR YOUR COMPANY OR ORGANIZATIONAL NAME)

Joseph Lstiburek, Building Science Corporation, self

Revise as follows:

IBC

Add new definition:

AIR-IMPERMEABLE INSULATION. An insulation having an air permeance equal to or less than 0.02 l/s-m² at 75 pa pressure differential tested according to astm e 2178 or e 283.

Add new section:

1203.2.2 Unvented attic and unvented enclosed rafter assemblies. unvented attic assemblies (spaces between the ceiling joists of the top story and the roof rafters) and unvented enclosed rafter assemblies (spaces between ceilings that are applied directly to the underside of roof framing members/rafters and the structural roof sheathing at the top of the roof framing members/rafters) shall be permitted if all the following conditions are met:

1. The unvented attic space is completely within the building thermal barrier.
2. No interior class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed rafter assembly.
3. Where wood shingles or shakes are used, a minimum 1/4 inch (6 mm) vented air space separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In climate zones 5, 6, 7 and 8, any air-impermeable insulation shall be a class II vapor retarder, or shall have a class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Either items 5.1 5.2 or 5.3 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
 - 5.1. Air-impermeable insulation only. Insulation shall be applied in direct contact with the underside of the structural roof sheathing.
 - 5.2. Air-permeable insulation only. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing as specified in table 1203.2.2 for condensation control.
 - 5.3 Air-impermeable and air-permeable insulation. The air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing as specified in table 1202.2.2 for condensation control. the air-permeable insulation shall be installed directly under the air-impermeable insulation.
 - 5.4 If preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.
6. This section does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals, art galleries, or enclosures in climate zones 5 or higher that are humidified beyond 35 percent during the three coldest months.

Copy Table R806.4 from the IRC and renumber as Table 1202.2.2

TABLE 1202.2.2 INSULATION FOR CONDENSATION CONTROL

[footnote section as below]

- a. Contributes to but does not supersede thermal resistance requirements for attic and roof assemblies.
- b. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45 degrees F (7 degrees C). For calculation purposes, an interior air temperature of 68 degrees F (20 degrees C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

Reason:

Unvented roof assemblies - both attic and cathedral ceiling - are a proven technology. They give the designer significant flexibility in locating mechanical equipment and ductwork inside of conditioned spaces thereby saving energy. They significantly improve the airtightness of the building enclosure thereby saving energy. They reduce wind uplift forces and reduce the risk of wildfire damage. They eliminate the problems associated with wind driven rain entering roof vents during hurricanes. The language in this proposed section is modeled on the existing language in the IRC Section 806.4.

Cost Impact: This proposal will not raise the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF



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A handwritten signature in black ink, appearing to read "J. Lstiburek", is written over a horizontal line.

Please type or print full name: Joseph William Lstiburek

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About this Report

This report was prepared with the cooperation of the U.S. Department of Energy's, Building America Program.

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