

**Appliance Standards and Rulemaking Federal Advisory Committee**  
*Manufactured Housing Working Group*  
Term Sheet  
October 31, 2014

## 1. Background

On June 13, 2014, the U.S. Department of Energy (DOE) issued a Notice of Intent to establish a negotiated rulemaking working group (WG) under the Appliance Standards and Rulemaking Federal Advisory Committee (ASRAC) in accordance with the Federal Advisory Committee Act (FACA) and the Negotiated Rulemaking Act (NRA) to negotiate proposed federal standards for energy efficiency in manufactured homes. *See* 79 FR 33873. The stated purpose of the WG was to discuss and, if possible, reach consensus on a proposed rule for the energy efficiency of manufactured homes, as authorized by section 413 of the Energy Independence and Security Act of 2007 (EISA).

On July 16, 2014, DOE announced the members of the WG, which consisted of representatives of parties with a defined stake in the outcome of the proposed standards. *See* 79 FR 41456. Specifically, the WG consisted of 22 members, including one member from ASRAC and one DOE representative (see Appendix A). The WG met in-person during six sets of meetings held on August 4-5, August 21-22, September 9-10, September 22-23, October 1-2, and October 23-24. *See* 79 FR 48097 and 79 FR 59154.

The WG successfully reached consensus on proposed energy efficiency standards for manufactured housing. This document includes the WG's recommendations to ASRAC on the proposed standards.

## 2. Applicable Aspects of the 2015 IECC

### Recommendation

The WG reviewed the 2015 International Energy Conservation Code (IECC) for residential buildings for applicability to manufactured housing over the course of the six public meetings. The WG identified sections of the 2015 IECC that were not applicable or that the WG modified. Consensus was reached on these items, as recorded in Appendix B.

**Vote:** Consensus<sup>1</sup> (19-yes; 1-no; 2-abstain<sup>2</sup>): October 24, 2014.

<sup>1</sup> For purposes of this WG, "consensus" was defined as at least a two-thirds "supermajority" in favor of the recommendation. Votes in favor of a recommendation included "thumbs-up" and "thumbs-sideways." Votes against a recommendation were indicated with a "thumbs-down."

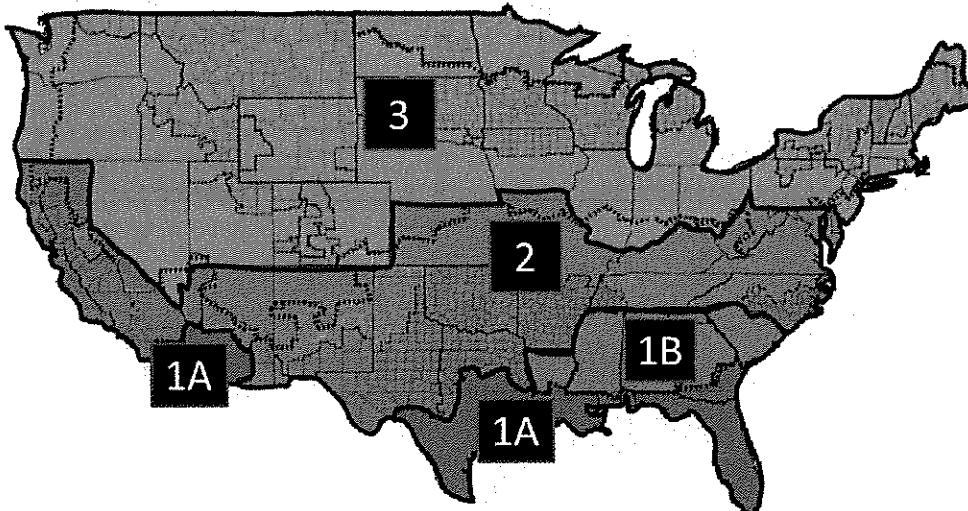
<sup>2</sup> Some recommendations did not receive votes from all 22 members, either due to a decision to abstain from voting or absence from the meeting.

### 3. Climate Zones

### 3.1. Recommendation

The WG recommends that the energy efficiency standards be based on the four climate zones in Figure 3.1.

### Figure 3.1 Climate Zone Map



**Vote:** Consensus (20-yes; 1-no; 1-abstain): October 23, 2014.

\* The WG did not consider Alaska, Hawaii, and U.S. Territories. DOE will determine zoning of those states and territories when it develops a Notice of Proposed Rulemaking (NPR).

### 3.2. Recommendation

The WG recommends using the naming convention of zone 1A, 1B, 2, and 3.

**Vote:** Consensus (20-yes; 0-no; 2-abstain): October 24, 2014.

#### 4. Building Thermal Envelope Pathways to Compliance

## Recommendation

The WG recommends allowing both a prescriptive path option (see section 5) and a performance path option (see section 6) to ensure improved energy efficiency of a manufactured home's building thermal envelope. The prescriptive path would specify a portfolio of specific building thermal envelope energy efficiency measures (e.g., R-30 ceiling insulation). The performance path would specify an overall building thermal envelope  $U$ -value ( $U_o$ ). Both building thermal envelope compliance pathways would also include the mandatory requirements summarized in section 7.

**Vote:** Consensus (20-yes; 0-no; 2-abstain): October 2, 2014.

## 5. Building Thermal Envelope Requirements: Prescriptive Path Option


### Recommendation

The WG recommends the prescriptive measures associated with the 4 climate zones outlined in Table 5.1. These measures would be the same for manufactured homes of all sizes (e.g., single- and multi-section manufactured homes).

**Table 5.1 Building Thermal Envelope Prescriptive Requirements**

Climate Zone	Ceiling (R-value)	Wall (R-value)	Floor (R-value)	Window (U-value)	Skylight (U-value)	Door (U-value)	Glazed Fenestration (SHGC)
1A	30	13	13	0.35	.75	0.40	0.25
1B	30	13	13	0.35	.75	0.40	Pending DOE Analysis*
2	30	21	19	0.35	.55	0.40	Pending DOE Analysis*
3	38	21	30	0.32	.55	0.40	No Rating

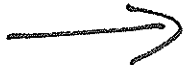
\*The WG did not reach consensus on prescriptive specifications for SHGC in climate zones 1B and 2, and has recommended that DOE determine these values after further analysis when it develops a NOPR.

 **Vote:** Consensus (20-yes; 1-no; 1-abstain): October 23, 2014.

### 5.1. Recommendation

The WG recommends the following footnotes apply to the prescriptive requirements listed in Table 5.1.

1. For conversion between units of length: 1 foot = 304.8 mm.
2. Table 5.1 includes the minimum R-values required to comply with DOE's proposed standards. U-value and SHGC specifications reflect maximum values.
3. The SHGC column of Table 5.1 applies to all glazed fenestration. Exception: Skylights may be excluded from building thermal envelope glazed fenestration SHGC requirements where the SHGC for such skylights does not exceed 0.30.
4. The floor R-value column assumes R-21 batt + R-14 blanket values to account for compression areas in the floor in climate zone 3.
5. The wall R-value column assumes a minimum truss heel height of 5.5 inches at the outside face of each exterior wall.
6. Each R-value column reflects the insulation manufacturers' published values. Uniform insulation thickness would not be mandatory as long as the required volume of insulation is installed with uniform density.

 **Vote:** Consensus (19-yes; 1-no; 2-abstain) October 24, 2014.

### 5.2. Recommendation

The WG recommends DOE complete further analysis to determine  $U$ -values for use as an alternative to the  $R$ -values listed in Table 5.1. Under this alternative  $U$ -value approach to the prescriptive path option of ensuring improved energy efficiency of a manufactured home's building thermal envelope, a manufacturer would need to comply with the window, skylight, and door  $U$ -values and the glazed fenestration SHGC specifications included in Table 5.1.

**Table 5.2  $U$ -Value Alternative for Ceiling, Wall, and Floor**

Climate Zone	Ceiling ( $U$ -value)	Wall ( $U$ -value)	Floor ( $U$ -value)
1A	Pending DOE Analysis*	Pending DOE Analysis*	Pending DOE Analysis*
1B	Pending DOE Analysis*	Pending DOE Analysis*	Pending DOE Analysis*
2	Pending DOE Analysis*	Pending DOE Analysis*	Pending DOE Analysis*
3	Pending DOE Analysis*	Pending DOE Analysis*	Pending DOE Analysis*

\* The WG did not reach consensus on the  $U$ -values for Table 5.2 and has recommended DOE determine these values after further analysis when it develops a NOPR.

→ **Vote:** Consensus (20-yes; 1-no; 1-abstain): October 24, 2014.

## 6. Building Thermal Envelope Requirements: $U_o$ Performance Path Option

### 6.1. Recommendation

The WG recommends the  $U_o$  values associated with the 4 climate zones in Table 6.1, and in connection with the number of sections in a manufactured home. The SHGC requirement shall be met in addition to  $U_o$  compliance. An area weighted average SHGC of windows, skylights, and doors more than 50 percent glazed shall satisfy the glazed fenestration SHGC requirements of Table 5.1.

**Vote: (recommendation text):** Consensus (19-yes; 1-no; 2-abstain): October 24, 2014.

**Table 6.1  $U_o$  Values for Performance Path**

Climate Zone	Single-Section $U_o$	Multi-Section $U_o$
1A	0.087	0.084
1B	0.087	0.084
2	0.070	0.068
3	0.059	0.056

→ **Vote (recommendation table):** Consensus (20-yes; 1-no; 1-abstain): October 23, 2014.

### 6.2. Recommendation

The WG recommends that the calculation of  $U_o$  follow the Battelle calculation method.<sup>3</sup> The Battelle calculation method produces an area-weighted average overall  $U$ -value for a home based on the thermal qualities and areas of material assemblies used in the home's construction.

**Vote:** Consensus (20-yes; 0-no; 2-abstain): October 24, 2014.

## 7. Other Mandatory Requirements

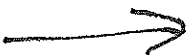
The WG recommends that the proposed regulations include the following requirements for all manufactured homes, regardless of the building thermal envelope compliance path selected:

### 7.1. Recommendation

The following requirements would establish compliant building thermal envelope air sealing. These proposed requirements are intended to provide a prescriptive path for reaching envelope tightness of 5 air changes per hour (ACH) when depressurized to 50 Pascals (Pa).

All manufactured homes would be required to be sealed against air leakage at all joints, seams, and penetrations associated with the building thermal envelope in accordance with the manufacturer's installation instructions, including ensuring that:

1. A continuous air barrier is established upon installation of all building thermal envelope (i.e., ceiling, walls, doors, and floor) opaque components.
2. Mating line surfaces (i.e., floor, exterior walls, and ceiling) are equipped with a continuous, durable gasket.
3. Gaps and penetrations in the ceilings, floors, and exterior surfaces of walls would be sealed with caulk, foam or gasket, or other suitable material. The following gaps and penetrations, at a minimum, would require sealing: ducts, flue shafts, plumbing, piping, electrical wiring, bathroom and kitchen exhaust fans, recessed lighting fixtures adjacent to unconditioned space, and light tubes adjacent to unconditioned space.
4. Rough openings around windows and exterior doors are sealed with caulk or foam.
5. Attic access panels and drop-down stairs are equipped with gaskets (i.e., not caulked) to produce a continuous air seal.
6. Duct system register boots that penetrate the building thermal envelope and/or air infiltration barrier are sealed to the air barrier or interior finish materials.
7. Sealing methods between dissimilar materials allow for differential expansion and contraction.

 **Vote:** Consensus (15-yes; 2-no; 5-abstain): September 23, 2014

### 7.2. Recommendation

The WG recommends that duct leakage must be no greater than 4 cubic feet per minute (CFM) per 100 square feet of floor area at a 25 Pa test pressure.

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<sup>3</sup> Conner C. C., Taylor, Z. T. "Overall U-Values and Heating/Cooling Loads – Manufactured Homes." Pacific Northwest Laboratory. 1992.

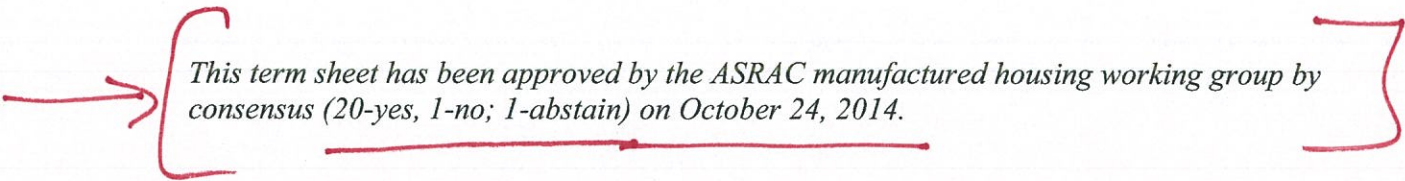
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**Vote:** Consensus (19-yes; 0-no; 3-abstain): September 22, 2014

### 7.3. Recommendation

All hot water pipes outside conditioned space would be required to be insulated to at least *R*-3. In addition, all hot water pipes from a water heater to a distribution manifold would be required to be insulated to at least *R*-3.

**Vote:** Consensus (17-yes; 0-no; 5-abstain): September 23, 2014



*This term sheet has been approved by the ASRAC manufactured housing working group by consensus (20-yes, 1-no; 1-abstain) on October 24, 2014.*

## **Appendix A: Working Group Members**

### **Manufactured Housing Negotiated Rulemaking Working Group**

#### **DOE and ASRAC Representatives**

Joseph Hagerman – Department of Energy

John Caskey - ASRAC, National Electrical Manufacturers Association

#### **Other Selected Members**

Bert Kessler - Palm Harbor Homes, Inc.

David Tompos - NTA, Inc.

Emanuel Levy - Systems Building Research Alliance

Eric Lacey - Responsible Energy Codes Alliance

Ishbel Dickens - National Manufactured Home Owners Association (NMHOA)

Keith Dennis - National Rural Electric Cooperative Association

Lois Starkey - Manufactured Housing Institute

Lowell Ungar - American Council for an Energy-Efficient Economy

Manuel Santana - Cavco Industries

Mark Ezzo - Clayton Homes, Inc.

Mark Weiss - Manufactured Housing Association for Regulatory Reform

Michael Lubliner - Washington State University Extension Energy Program

Michael Wade - Cavalier Home Builders

Peter Schneider - Efficiency Vermont

Richard Hanger - Housing Technology and Standards

Richard Potts - Virginia Department of Housing and Community Development

Rob Luter - Lippert Components, Inc.

Robin Roy - Natural Resources Defense Council

Scott Drake - East Kentucky Power Cooperative

Stacey Epperson - Next Step Network