

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

Other Recommendations Outside the Scope of the Working Group

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. During the process of discussing energy efficiency standards for a proposed rule the WG considered recommendations that would support the standards but were outside the scope of the WG charter. This document includes the WG's recommendations outside the scope of the WG.

1. Recommendation

The WG recommends that DOE charter a new working group through ASRAC to develop recommendations regarding certification-testing and enforcement for the proposed federal standards for energy efficiency in manufactured homes.

2. Recommendation

The WG recommends that DOE modify the REScheck¹ software application to specifically address manufactured housing. The WG observed that both inputs and calculation assumptions (e.g., the siting orientation of the home) would require modification to account for the factory construction of manufactured homes. The modified application also would provide recommendations for equipment sizing.

3. Recommendation

The WG recommends that DOE consider development of a duct sizing tool, potentially based on the Air Conditioning Contractors of America (ACCA) Manual D.

4. Recommendation

The WG has three recommendations involving building thermal envelope sealing:

1. DOE conduct testing to confirm an average ACH of 5 is achieved in practice with the 7 prescriptive recommendations listed in Recommendation 7.1 of the term sheet. This

¹ <https://www.energycodes.gov/rescheck>

testing could inform future decisions and regulations regarding building thermal envelope sealing.

2. DOE conduct a WUFI² analysis to assess potential moisture concerns of the proposed package on exterior walls. This analysis could inform future decisions and regulations regarding building thermal envelope sealing.
3. DOE consider approaches to address a scenario in which an exterior surface of a wall cannot be sealed, such as the case in which the exterior sheathing is also the structural sheathing, and the resulting impact to the building thermal envelope visual inspection requirements included in the manufactured housing term sheet.

5. Recommendation

The WG recommends that DOE consider labeling approaches that provide (1) voluntary labeling for whole-house performance information, (2) heating/cooling equipment sizing parameters capable of servicing a home with the highest expected heating and cooling load, and (3) additional information on building components and equipment.

6. Recommendation

The WG recommends DOE consider an education program on energy efficiency for potential owners of manufactured housing.

7. Recommendation

The WG recommends that DOE consider government supports/grants/subsidies/etc. for energy efficiency, and that DOE consider increasing DOE R&D funding to a level commensurate with the role of manufactured housing in the nation's housing mix.

8. Recommendation

The WG recommends DOE consider an education program on non-energy benefits for potential owners of manufactured housing including indoor air quality, comfort, and durability.

9. Recommendation

The WG recommends DOE discuss the following revisions to Subpart F of 24 CFR Part 3280 (including additions from the International Residential Code) with the Department of Housing and Urban Development. DOE should discuss these recommendations with the Department of Housing and Urban Development to address duplications and inconsistencies between the current 24 CFR Part 3280 and DOE's eventual notice of proposed rulemaking. The items crossed out are items the WG recommends deleting.

§ 3280.504 Condensation control and installation of vapor retarders.

² http://apps1.eere.energy.gov/buildings/tools_directory/software.cfm/ID=362/pagename=alpha_list

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(a) Ceiling vapor retarders. (1) In Uo Value Zones 2 and 3, ceilings must have a vapor retarder with a permeance of not greater than 1 perm (as measured by ASTM E 96–95 Standard Test Methods for Water Vapor Transmission of Materials) (incorporated by reference, see § 3280.4) installed on the living space side of the roof cavity.

(2) For manufactured homes designed for Uo Value Zone 1, the vapor retarder may be omitted.

Replace § 3280.504(b) in its entirety with:

(IRC) R702.7 Vapor retarders.

Class I or II vapor retarders are required on the interior side of frame walls in Climate Zones 2 and 3.

(IRC)R702.7.2 Material vapor retarder class.

The vapor retarder class shall be based on the manufacturer’s certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, unperforated aluminum foil.

Class II: Kraft-faced fiberglass batts.

Class III: Latex or enamel paint.

From 3280.504:

(c) Liquid applied vapor retarders. Each liquid applied vapor retarder must be tested by a nationally recognized testing agency for use on the specific substrate to which it is applied. The test report must include the perm rating, as measured by ASTM E 96–95, Standard Test Methods.

Replace 3280.504(d) in its entirety with:

(IRC) R806.1 Ventilation required.

Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than 1/4 inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, or similar material with openings having a least dimension of 1/16 inch (1.6 mm) minimum and 1/4 inch (6.4 mm) maximum.

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Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air.

R806.2 Minimum vent area.

The minimum net free ventilating area shall be 1/150 of the area of the vented space.

Exception: The minimum net free ventilation area shall be 1/300 of the vented space provided one or more of the following conditions are met:

1. In Climate Zone 3, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. At least 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located no more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the required ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

R806.3 Vent and insulation clearance.

Where eave or cornice vents are installed, insulation shall not block the free flow of air. A minimum of a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

R806.4 Installation and weather protection.

Ventilators shall be installed in accordance with manufacturer's installation instructions. ~~Installation of ventilators in roof systems shall be in accordance with the requirements of Section R903. Installation of ventilators in wall systems shall be in accordance with the requirements of Section R703.1.~~

R806.5 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.

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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~~ Zone 3, any air-impermeable insulation shall be a Class II vapor retarder, or shall have a Class III 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 R806.5 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 R806.5 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

5.4. Where 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. (ii) A mechanical attic or roof ventilation system may be installed instead of providing the free ventilation area when the mechanical system provides a minimum air change rate of 0.02 cubic feet per minute (cfm) per sq. ft. of attic floor area. Intake and exhaust vents shall be located so as to provide air movement throughout space.

(2) Single section manufactured homes constructed with metal roofs and having no sheathing or underlayment installed, are not required to be provided with attic or roof cavity ventilation provided that the air leakage paths from the living space to the roof cavity created by electrical outlets, electrical junctions, electrical cable penetrations, plumbing penetrations, flue pipe penetrations and exhaust vent penetrations are sealed.

(3) Parallel membrane roof section of a closed cell type construction are not required to be ventilated.

(4) The vents provided for ventilating attics and roof cavities shall be designed to resist entry of rain and insects.

Note: 505 Air infiltration is replaced by R402.4 including table R402.4.1.1

506 is replaced by Manual J

507 replaced by new labeling requirements

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§ 3280.508 Heat loss, heat gain and cooling load calculations.

(a) Information, values and data necessary for heat loss and heat gain determinations must be taken from the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition, chapters 22 through 27. The following portions of those chapters are not applicable:

23.1 Steel Frame Construction

23.2 Masonry Construction

23.3 Foundations and Floor Systems

23.15 Pipes

23.17 Tanks, Vessels, and Equipment

23.18 Refrigerated Rooms and Buildings

24.18 Mechanical and Industrial Systems

25.19 Commercial Building Envelope Leakage

27.9 Calculation of Heat Loss from Crawl Spaces

(b) The calculation of the manufactured home's transmission heat loss coefficient (U_o) must be in accordance with the fundamental principles of the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition, and, at a minimum, must address all the heat loss or heat gain considerations in a manner consistent with the calculation procedures provided in the document, Overall U-values and Heating/Cooling Loads—Manufactured Homes—February 1992—PNL 8006, HUD User No. 0005945.

(c) Areas where the insulation does not fully cover a surface or is compressed shall be accounted for in the U calculation (see §3280.506). The effect of framing on the U-value must be included in the U_o calculation. Other low-R-value heat-flow paths (“thermal shorts”) shall be explicitly accounted for in the calculation of the transmission heat loss coefficient if in the aggregate all types of low-R-value paths amount to more than 1% of the total exterior surface area. Areas are considered low-R-value heat-flow paths if:

(1) They separate conditioned and unconditioned space; and

(2) They are not insulated to a level that is at least one-half the nominal insulation level of the surrounding building component.

§ 3280.509 Criteria in absence of specific data.

In the absence of specific data, for purposes of heat-loss/gain calculation, the following criteria shall be used:

~~(a) Infiltration heat loss. In the absence of measured infiltration heat loss data, the following formula shall be used to calculate heat loss due to infiltration and intermittently operated fans exhausting to the outdoors. The perimeter calculation shall be based on the dimensions of the pressure envelope. Infiltration Heat Loss=0.7 (T) (ft. of perimeter), BTU/hr.~~

~~where: T=70 minus the heating system capacity certification temperature stipulated in the Heating Certificate, in F.~~

(b) Framing areas.

Wall 15 percent of wall area less windows and doors.

Floor and Ceiling 10 percent of the area.

(c) Insulation compression. Insulation compressed to less than nominal thickness and loose-fill insulation in sloping cavities must have its nominal R-values reduced in compressed areas in accordance with the following table:

EFFECT OF INSULATION COMPRESSION AND RESTRICTIONS ON R-VALUES

Effect of Insulation Compression and Restriction on R-Values								
Original Thickness (%)	Non-uniform (a) restriction		Uniform (b) compression batt (%)		Original Thickness (%)	Non-uniform (a) restriction		Uniform (b) compression batt (%)
	Batt (%)	Blown (%)				Batt (%)	Blown (%)	
0	20	15	0		51	81	73	62
1	26	21	1		52	81	73	63
2	32	25	2		53	82	74	64
3	36	28	4		54	82	75	65
4	38	30	5		55	83	75	65
5	41	32	7		56	83	76	66
6	43	33	8		57	84	76	67
7	45	35	10		58	84	77	68
8	46	36	11		59	84	78	69
9	48	38	13		60	85	78	70
10	49	39	14		61	85	79	71
11	51	40	15		62	86	79	72
12	52	42	17		63	86	80	73
13	53	43	18		64	87	81	74
14	54	44	20		65	87	81	74
15	55	45	21		66	88	82	75
16	57	46	22		67	88	82	76
17	58	47	24		68	88	83	77
18	59	48	25		69	89	84	78
19	59	49	26		70	89	84	78
20	60	50	28		71	90	85	79
21	61	51	29		72	90	85	80

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22	62	52	30		73	90	86	81
23	63	52	31		74	90	86	82
24	64	53	33		75	91	87	82
25	65	54	34		76	91	87	83
26	65	55	35		77	92	88	84
27	66	56	36		78	92	89	85
28	67	57	37		79	93	89	85
29	68	57	39		80	93	90	86
30	68	58	40		81	93	90	87
31	69	59	41		82	94	91	88
32	70	60	42		83	94	91	88
33	70	60	43		84	95	92	89
34	71	61	44		85	95	92	90
35	72	62	45		86	96	93	91
36	72	63	47		87	96	93	91
37	73	63	48		88	96	94	92
38	74	64	49		89	96	94	93
39	74	65	50		90	97	95	93
40	75	65	51		91	97	95	94
41	75	66	52		92	97	96	95
42	76	67	53		93	98	96	95
43	76	68	54		94	98	97	96
44	77	68	55		95	98	97	97
45	78	69	56		96	99	98	97
46	78	70	57		97	99	98	98
47	79	70	58		98	99	99	99
48	79	71	59		00	100	99	99
49	80	71	60		100	100	100	100
50	80	72	61					

*Note: To use this table, first compute the restricted insulation thickness as a fraction of the uncompressed (full) insulation thickness. Then look up the R-value remaining from the appropriate column (Nonuniform Restriction, Batt Nonuniform restriction, Blown or Uniform compression, Batt). Example: Assume a section of loose-fill ceiling insulation went from R-25 insulation at a height of 10 inches to a minimum height of 2 inches at the edge of the ceiling. The ratio of minimum to full thickness is 0.20 (2 divided by 10). Look up 0.20 (20 percent), read across to column 3 (Non-uniform Restriction, Blown), and read 50 percent. Therefore, the R-value of the loose-fill insulation over the restricted area would be R- 12.5(50 percent of 25). (a) Non-uniform restriction is that which occurs between non-parallel planes, such as in the ceiling near the eaves. (b) Uniform compression is compression between parallel planes, such as that which occurs in a wall.

When insulation is installed over the framing members the thermal performance of the insulation is reduced due to compression at the framing members. The Resistance value of the insulation between the framing members is reduced by 12.5 percent for framing members 16&inch; O.C., 8.5 percent for framing members 24&inch; O.C., and 4 percent for framing members 48&inch; O.C.

(d) Air supply ducts within floor cavity. Air supply ducts located within a floor cavity shall be assumed to be heating or cooling the floor cavity to living space temperatures unless the duct is

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structurally isolated by the framing system or thermally insulated from the rest of the floor cavity with a thermal insulation at least equal to R-4.

(e) Air supply ducts within ceiling cavity. Where supply ducts are located in ceiling cavities, the influence of the duct on cavity temperatures shall be considered in calculating envelope heat loss or heat gain.

~~(f) The supply duct loss (and/or heat gain where applicable — See §3280.511) shall be calculated using the actual duct surface area and the actual thickness of insulation between the duct and outside of the manufactured home. If there is an air space of at least ½ inch between the duct and the insulation, heat loss/gain need not be calculated if the cavity in which the duct is located is assumed to be at living space temperature. The average temperature inside the supply duct, including ducts installed outside the manufactured home, shall be assumed to be 130 F for purposes of calculation of heat loss and 60 F for heat gain.~~

(g) Return air cavities. Cavities used as return air plenums shall be considered to be at living space temperature.