

## § 3280.505

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(c) *Attic or roof ventilation.* (1) Attic and roof cavities shall be vented in accordance with one of the following:

(i) A minimum free ventilation area of not less than 1/300 of the attic or roof cavity floor area. At least 50 percent of the required free ventilation area shall be provided by ventilators located in the upper portion of the space to be ventilated. At least 40 percent shall be provided by eave, soffit or low gable vents. The location and spacing of the vent openings and ventilators shall provide cross-ventilation to the entire attic or roof cavity space. A clear air passage space having a minimum height of 1 inch shall be provided between the top of the insulation and the roof sheathing or roof covering. Baffles or other means shall be provided where needed to insure the 1 inch height of the clear air passage space is maintained.

(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

## 24 CFR Ch. XX (4–1–10 Edition)

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.

[40 FR 58752, Dec. 18, 1975. Redesignated at 44 FR 20679, Apr. 6, 1979, as amended at 58 FR 55009, Oct. 25, 1993; 70 FR 72046, Nov. 30, 2005; 71 FR 19639, Apr. 17, 2006]

### § 3280.505 Air infiltration.

(a) *Envelope air infiltration.* The opaque envelope shall be designed and constructed to limit air infiltration to the living area of the home. Any design, material, method or combination thereof which accomplishes this goal may be used. The goal of the infiltration control criteria is to reduce heat loss/heat gain due to infiltration as much as possible without impinging on health and comfort and within the limits of reasonable economics.

(1) *Envelope penetrations.* Plumbing, mechanical and electrical penetrations of the pressure envelope not exempted by this part, and installations of window and door frames shall be constructed or treated to limit air infiltration. Penetrations of the pressure envelope made by electrical equipment, other than distribution panel boards and cable and conduit penetrations, are exempt from this requirement. Cable penetrations through outlet boxes are considered exempt.

(2) *Joints between major envelope elements.* Joints not designed to limit air infiltration between wall-to-wall, wall-to-ceiling and wall-to-floor connections shall be caulked or otherwise sealed. When walls are constructed to form a pressure envelope on the outside of the wall cavity, they are deemed to meet this requirement.

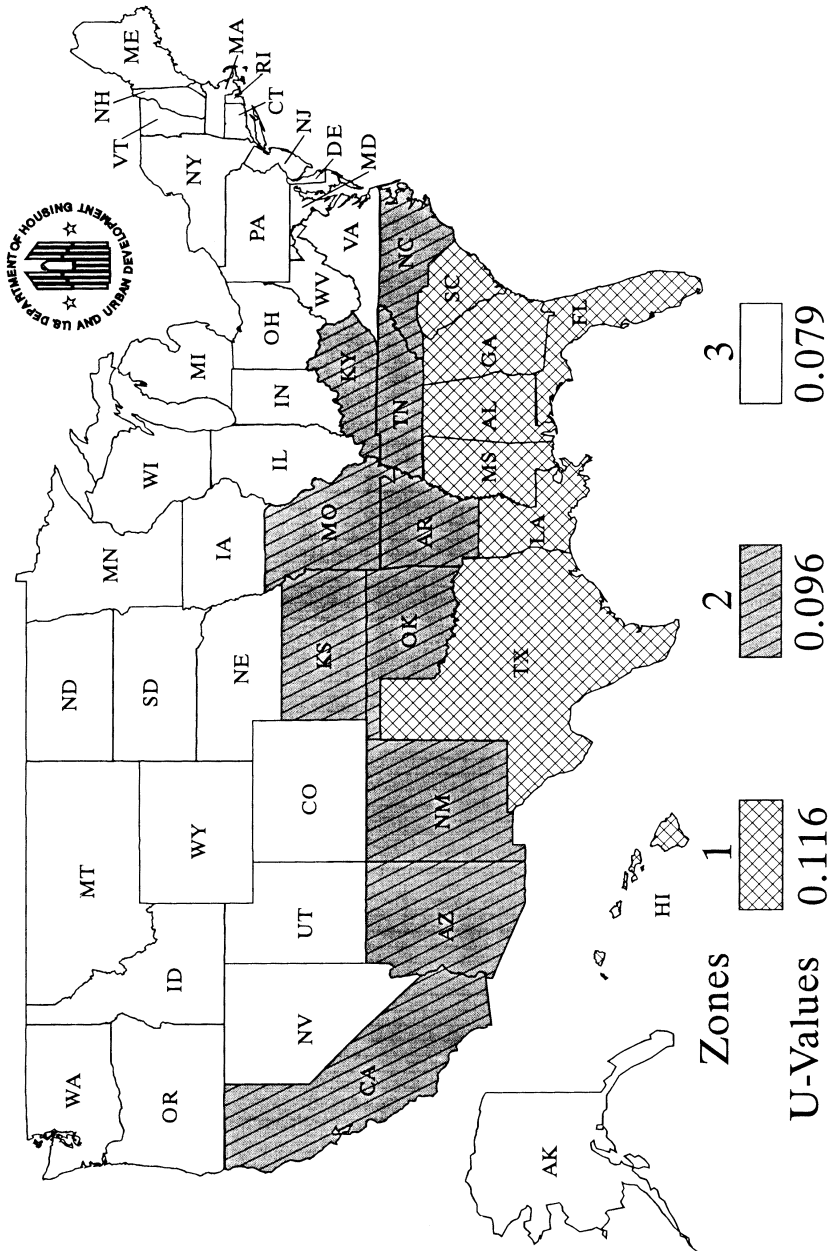
### § 3280.506 Heat loss/heat gain.

The manufactured home heat loss/heat gain shall be determined by methods outlined in §§ 3280.508 and 3280.509. The U<sub>o</sub> (Coefficient of heat transmission) value zone for which the manufactured home is acceptable and the

lowest outdoor temperature to which the installed heating equipment will maintain a temperature of 70 F shall be

certified as specified in § 3280.510 of this subpart. The U<sub>o</sub> value zone shall be determined from the map in figure 506.

U/O Value Zone Map for Manufactured Housing



**§ 3280.507**

**24 CFR Ch. XX (4-1-10 Edition)**

(a) *Coefficient of heat transmission.* The overall coefficient of heat transmission ( $U_o$ ) of the manufactured home for the respective zones and an indoor design temperature of 70 F, including internal and external ducts, and excluding infiltration, ventilation and condensation control, shall not exceed the Btu/(hr.) (sq. ft.) (F) of the manufactured home envelope are as tabulated below:

Uo value zone	Maximum coefficient of heat transmission
1 .....	0.116 Btu/(hr.) (sq. ft.) (F).
2 .....	0.096 Btu/(hr.) (sq. ft.) (F).
3 .....	0.079 Btu/(hr.) (sq. ft.) (F).

(b) To assure uniform heat transmission in manufactured homes, cavities in exterior walls, floors, and ceilings shall be provided with thermal insulation.

(c) Manufactured homes designed for Uo Value Zone 3 shall be factory equipped with storm windows or insulating glass.

[58 FR 55009, Oct. 25, 1993; 59 FR 15113, Mar. 31, 1994]

**§ 3280.507 Comfort heat gain.**

Information necessary to calculate the home cooling load shall be provided as specified in this part.

(a) *Transmission heat gains.* Homes complying with this section shall meet the minimum heat loss transmission coefficients specified in §3280.506(a).

**§ 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.

(d) *High efficiency heating and cooling equipment credit.* The calculated transmission heat loss coefficient ( $U_o$ ) used for meeting the requirement in §3280.506(a) may be adjusted for heating and cooling equipment above that required by the National Appliance Energy Conservation Act of 1987 (NAECA) by applying the following formula:

$$U_o \text{ adjusted} = U_o \text{ standard} \times [1 + (0.6) (\text{heating efficiency increase factor}) + (\text{cooling multiplier}) (\text{cooling efficiency increase factor})]$$

where:

$U_o$  standard = Maximum  $U_o$  for  $U_o$  Zone required by §3280.506(a)

$U_o$  adjusted = Maximum  $U_o$  standard adjusted for high efficiency HVAC equipment  
 Heating efficiency increase factor = The increase factor in heating equipment efficiency measured by the Annual Fuel Utilization Efficiency (AFUE), or the Heating Seasonal Performance Factor (HSPF) for heat pumps, above that required by