

§ 3280.507

manufactured home envelope are as tabulated in the table to this paragraph (b):

TABLE 1 TO PARAGRAPH (B)

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).

(c) To assure uniform heat transmission in manufactured homes, cavities in exterior walls, floors, and ceilings must be provided with thermal insulation. For insulation purposes, the fire separation wall between each single family attached manufactured home shall be considered an exterior wall (see subpart K of this part).

(d) 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; 86 FR 2521, Jan. 12, 2021]

§ 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 co-

efficient (Uo) 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 Uo 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 (Uo) 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:

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

where:

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

Uo adjusted = Maximum Uo 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 NAECA (indicated as “NAECA” in formula). The formula is heating efficiency

increase factor = AFUE (HSPF) home – AFUE (or HSPF) NAECA divided by AFUE (HSPF) NAECA.

Cooling efficiency increase factor = the increase factor in the cooling equipment efficiency measured by the Seasonal Energy Efficiency Ratio (SEER) above that required by NAECA.

The formula being cooling equipment = SEER home—SEER NAECA divided by SEER NAECA.

The cooling multiplier for the U_o Zone is from the following table:

U _o zone	Cooling multiplier (C _m)
1	0.60 (Florida only).
1	0.20 (All other locations).
2	0.07.
3	0.03.

(e) U values for any glazing (e.g., windows, skylights, and the glazed portions of any door) must be based on tests using AAMA 1503.1–1988, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections, or the National Fenestration Rating Council 100, 1997 Edition, Procedure for Determining Fenestration Product U-factors. In the absence of tests, manufacturers are to use the residential window U values contained in Chapter 29, Table 5 of the 1997 ASHRAE Handbook of Fundamentals, Inch-Pound Edition. In the event that the classification of the window type is indeterminate, the manufacturer must use the classification that gives the higher U value. Where a composite of materials from two different product types is used, the product is to be assigned the higher U value. For the purpose of calculating U_o values, storm windows are treated as an additional pane.

(f) *Annual energy used based compliance.* As an alternative, homes may demonstrate compliance with the annual energy used implicit in the coefficient of heat transmission (U_o) requirement. The annual energy use determination must be based on generally accepted engineering practices. The general requirement is to demonstrate that the home seeking compliance approval has a projected annual energy use, including both heating and cooling, less than or equal to a similar “base case” home that meets the

standard. The energy use for both homes must be calculated based on the same assumptions; including assuming the same dimensions for all boundaries between conditioned and unconditioned spaces, site characteristics, usage patterns and climate.

[58 FR 55011, Oct. 25, 1993, as amended at 70 FR 72047, Nov. 30, 2005]

§ 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.

$$\text{Infiltration Heat-Loss} = 0.7 (T) (\text{ft. of perimeter}), \text{ BTU/hr.}$$

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:

TABLE TO PARAGRAPH (C)—EFFECT OF INSULATION COMPRESSION AND RESTRICTION ON R-VALUES

Original thickness (%)	Non-uniform (a) restriction		Uniform (b) compression batt (%)
	Batt (%)	Blown (%)	
0	20	15	0
1	26	21	1
2	32	25	2
3	36	28	4
4	38	30	5
5	41	32	7
6	43	33	8
7	45	35	10
8	46	36	11
9	48	38	13
10	49	39	14
11	51	40	15
12	52	42	17