

Comparison Of the HERS Reference Home, HERS Rated Home & ENERGY STAR Reference Design Home

The following information for the HERS Reference and Rated Homes is a duplication of Table 303.4.1(1) in the RESNET 2006 Mortgage Industry National Home Energy Rating Systems Standards with the exception of footnotes. It is provided for comparison to the ENERGY STAR Reference Design Home defined in the 2011 ENERGY STAR Qualified New Homes guidelines.

| Building Component | HERS Reference Home | HERS Rated Home | ENERGY STAR Reference Design Home |
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| Above-Grade Walls: | Type: Wood frame | Same as Rated Home | Type: Wood frame, with 17% framing fraction |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | U-Factor: From RESNET Table 303.4.1(2) | Same as Rated Home | Wood frame wall R-values from 2009 IECC, Table 402.1.1; assuming Grade I installation |
| | Solar absorptance = 0.75 | Same as Rated Home | Same as Rated Home |
| | Emittance = 0.90 | Same as Rated Home | Same as Rated Home |
| Conditioned Basement Walls: | Type: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | U-Factor: From RESNET Table 303.4.1(2) with the insulation layer on the interior side of walls | Same as Rated Home | Basement Wall R-values from 2009 IECC, Table 402.1.1; Assuming Grade I installation and with insulation layer on the interior side of walls |
| Floors Over Unconditioned Spaces: | Type: Wood frame | Same as Rated Home | Type: Wood frame |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | U-Factor: From RESNET Table 303.4.1(2) | Same as Rated Home | Floor R-values from 2009 IECC, Table 402.1.1; Assuming Grade I installation |
| Ceilings: | Type: Wood frame | Same as Rated Home | Type: Wood frame, with 7% framing fraction |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | U-Factor: From RESNET Table 303.4.1(2) | Same as Rated Home | Ceiling R-values from 2009 IECC, Table 402.1.1; Assuming Grade I installation |
| Roofs: | Type: Composition shingle on wood sheathing | Same as Rated Home | Type: Composition shingle on wood sheathing |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | Solar Absorptance = 0.75 | Values from Table RESNET 303.4.1.(4) ¹ | Solar Absorptance = 0.92 |
| | Emittance = 0.90 | Emittance values provided by the roofing manufacturer, when available ² | Emittance = 0.90 |
| Attics: | Type: Vented with aperture = 1ft ² per 300 ft ² ceiling area | Same as Rated Home | Type: Vented with aperture = 1ft ² per 300 ft ² ceiling area Radiant Barrier: In climate zones 1-3, if ≥ 10 linear ft of ductwork are located in unconditioned attic, then a radiant barrier shall be installed |
| Foundations: | Type: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | Gross Area: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | U-Factor / R-value: From RESNET Table 303.4.1(2) | Same as Rated Home | Slab Wall R-values and Slab Depth from 2009 IECC, Table 402.1.1, as appropriate; Assuming Grade I installation |

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| Crawlspaces: | Type: Vented with net free vent aperture = 1ft ² per 150 ft ² of crawlspace floor area | Same as the Rated Home ³ | Type: Vented with net free vent aperture = 1ft ² per 150 ft ² of crawlspace floor area |
| | U-factor: From RESNET Table 303.4.1(2) for floors over unconditioned spaces. | Same as Rated Home | Floor R-values from 2009 IECC, Table 402.1.1.; Assuming Grade I installation |
| Doors: | Area: 40 ft ² | Same as Rated Home | Same as Rated Home |
| | Orientation: North | Same as Rated Home | Same as Rated Home |
| | U-factor: Same as fenestration from RESNET Table 303.4.1(2) | Same as Rated Home | ENERGY STAR qualified doors |
| Glazing: | Total Area = 18% of conditioned floor area | Same as Rated Home | Total Area = 18% of conditioned floor area ⁴ |
| | Orientation: Equally distributed to four (4) cardinal compass orientations (N, E, S, & W) | Same as Rated Home | Orientation: Equally distributed to four (4) cardinal compass orientations (N, E, S, & W) |
| | U-factor: From RESNET Table 303.4.1(2) | Same as Rated Home | ENERGY STAR Windows except as follows: CZ 2: U-value ≤ 0.55 CZ 4: U-value ≤ 0.40 |
| | SHGC: From RESNET Table 303.4.1(2) | Same as Rated Home | ENERGY STAR Windows except as follows: CZ 2: SHGC ≤ 0.35 CZ 4: SHGC ≤ 0.45 |
| | Interior shade coefficient: Summer = 0.70 Winter = 0.85 | Same as HERS Reference Home | Same as HERS Reference Home |
| | External Shading: None | Same as Rated Home | External Shading: None |
| Skylights: | None | Same as Rated Home | None |
| Thermally Isolated Sunrooms: | None | Same as Rated Home | None |
| Air Exchange Rate: | Specific Leakage Area (SLA) = 0.00048 (assuming no energy recovery) | For residences that are not tested, the same as the HERS Reference Home | Measured air exchange rate as follows: CZ 1-2: 7 ACH50; CZ 3-4: 6 ACH50 CZ 5-7: 5 ACH50; CZ 8: 4 ACH50. Assuming continuously operating mechanical ventilation system with a delivered ventilation rate compliant with ASHRAE 62.2, 2007, Section 4.4. |
| | | For residences without mechanical ventilation systems that are tested in accordance with ASHRAE Standard 119, Section 5.1, the measured air exchange rate but not less than 0.35 ach | |
| | | For residences with mechanical ventilation systems that are tested in accordance with ASHRAE Standard 119, Section 5.1, the measured air exchange rate combined with the mechanical ventilation rate, which shall not be less than 0.01 x CFA + 7.5 x (Nbr+1) cfm | |

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| Mechanical Ventilation: | None, except where a mechanical ventilation system is specified by the Rated Home, in which case: Annual vent fan energy use: kWh/yr = $0.03942 \cdot \text{CFA} + 29.565 \cdot (\text{Nbr} + 1)$ (per dwelling unit) where: CFA = conditioned floor area Nbr = number of bedrooms | Same as Rated Home | Mechanical ventilation system with annual vent fan energy use: kWh/yr = $0.03942 \cdot \text{CFA} + 29.565 \cdot (\text{Nbr} + 1)$ (per dwelling unit) where: CFA = conditioned floor area Nbr = number of bedrooms |
| Internal Gains: | IGain = $17,900 + 23.8 \cdot \text{CFA} + 4104 \cdot \text{Nbr}$ (Btu/day per dwelling unit) | Same as HERS Reference Home, except as provided by RESNET Section 303.4.1.7. | Same as HERS Reference Home, except as provided by RESNET Section 303.4.1.7, assuming 80% fluorescent lighting, mechanical ventilation system fan, ENERGY STAR qualified refrigerator, dishwasher, and ceiling fans |
| Internal Mass: | An internal mass for furniture and contents of 8 pounds per square foot of floor area | Same as HERS Reference Home, plus any additional mass specifically designed as a Thermal Storage Element but not integral to the building envelope or structure | An internal mass for furniture and contents of 8 pounds per square foot of floor area |
| Structural Mass: | For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air | Same as Rated Home | For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air |
| | For masonry basement walls, same as Rated Home, but with insulation required by RESNET Table 303.4.1(2) located on the interior side of the walls | Same as Rated Home | For masonry basement walls, same as Rated Home, but with basement wall R-values from 2009 IECC, Table 402.1.1; Assuming Grade I installation and with insulation layer on the interior side of walls |
| | For other walls, for ceilings, floors, and interior walls, wood frame construction | Same as Rated Home | For other walls, for ceilings, floors, and interior walls, wood frame construction |
| Heating Systems: | Fuel Type: Same as Rated Home | Same as Rated Home | Same as Rated Home |
| | Electric Efficiency: Air source heat pump with prevailing federal minimum efficiency | Same as Rated Home | CZ 1-3: 8.2 HSPF / 14.5 SEER / 12 EER ASHP CZ 4-8: 8.5 HSPF / 14.5 SEER / 12 EER ASHP |
| | Non-electric Furnace Efficiency: Natural gas furnace with prevailing federal minimum efficiency | Same as Rated Home | CZ 1-3: 80 AFUE for all furnaces CZ 4-8: 92 AFUE for gas furnaces CZ 4-8: 85 AFUE for oil furnaces |
| | Non-electric Boiler Efficiency: Natural gas boiler with prevailing federal minimum efficiency | Same as Rated Home | CZ 1-3: 80 AFUE for all boilers CZ 4-8: 85 AFUE for all boilers |
| | Capacity: Sized in accordance with Section 303.5.1.4 of the RESNET Standard. | Same as Rated Home | Capacity: Sized in accordance with Section 303.5.1.4 of the RESNET Standard |
| Cooling Systems: | Fuel Type: Electric | Same as Rated Home | Same as Rated Home |
| | Efficiency: In accordance with prevailing federal minimum standards | Same as Rated Home | CZ 1-3: 14.5 SEER/12 EER AC, with sensible heat ratio = 0.70 CZ 4-8: 13 SEER AC |
| | Capacity: Sized in accordance with Section 303.5.1.4 of the RESNET Standard. | Same as Rated Home | Capacity: Sized in accordance with Section 303.5.1.4 of the RESNET Standard |

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| Service Water Heating Systems: | Fuel Type: Same as Rated Home | Same as Rated Home | Fuel Type: Same as Rated Home |
| | Efficiency: In accordance with prevailing federal minimum standards | Same as Rated Home | Efficiency: Gas - 0.61 EF; Electric - 0.92 EF |
| | Use (gal/day): $30 \cdot N_{du} + 10 \cdot N_{br}$ where N_{du} = number of dwelling units | Same as HERS Reference Home | Same as HERS Reference Home |
| | Tank temperature: 120°F | Same as HERS Reference Home | Same as HERS Reference Home |
| Thermal Distribution Systems: | A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies. | As specified by RESNET Table 303.4.1(3), except when tested in accordance with ASHRAE Standard 152-2004, and then either calculated through hourly simulation or calculated in accordance with ASHRAE Standard 152-2004 | Duct Leakage to Outside: 4 CFM/100 ft ² of conditioned floor area |
| | | | Duct Insulation: Attic: R-8; Other Uncond. Spaces: R-6 |
| | | | Duct Surface Area: Same as Rated Home |
| | | | Duct Location, Per # Stories & Foundation Type: 1-Story / Slab: 100% in Attic; 2-Story / Slab: 75% in Attic; 25% in Cond. Space; 1-Story / Crawl: 100% in Crawlspace; 2-Story / Crawl: 75% in Crawl; 25% in Cond. Space; 1-Story / Bsmt: 100% in Basement; 2-Story / Bsmt: 75% in Bsmt; 25% in Cond. Space. |
| Thermostat: | Type: Manual | Type: Same as Rated Home | Type: Programmable |
| | Temperature setpoints: Cooling temperature set point = 78°F; Heating temperature set point = 68°F | Temperature setpoints: Same as the HERS Reference Home, except as required by RESNET Section 303.5.1.2 | Temperature setpoints: Same as the HERS Reference Home, except as required by RESNET Section 303.5.1.2 |

Footnotes:

1. Except where test data are provided for roof surface in accordance with ASTM methods E-903, C-1549, E-1918, or CRRC Method # 1.
2. Emittance values provided by the roofing manufacturer in accordance with ASTM C-1371 shall be used when available. In cases where the appropriate data are not known, the value shall be the same as the Reference Home.
3. Same as the Rated Home, net free ventilation area shall not be less than the Reference Home unless an approved ground cover in accordance with IRC 408.1 is used, in which case, the net free ventilation area shall be the same as the Rated Home down to a minimum net free vent area of 1ft² per 1,500 ft² of crawlspace floor area.
4. For homes with conditioned basements and for multi-family attached homes the following formula shall be used to determine total window area:

$$AF = 0.18 \times AFL \times FA \times F$$

where:

AF = Total fenestration area

AFL = Total floor area of directly conditioned space

FA = (Above-grade thermal boundary gross wall area) / (above-grade boundary wall area + 0.5 x below-grade boundary wall area)

F = 1 - 0.44 * (Common Wall Area) / (above-grade thermal boundary wall area + common wall area)

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions;

Above-grade thermal boundary wall is any portion of a thermal boundary wall not in contact with soil;

Below-grade boundary wall is any portion of a thermal boundary wall in soil contact; and

Common wall is the total wall area of walls adjacent to another conditioned living unit, not including foundation walls.