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
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 = 1ft² per 300 ft² ceiling area	Same as Rated Home	Type: Vented with aperture = 1ft² per 300 ft² 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

Crawlspaces:	Type: Vented with net free vent aperture = 1ft² per 150 ft² of crawlspace floor area	Same as the Rated Home[3]	Type: Vented with net free vent aperture = 1ft² per 150 ft² 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 ft²	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	

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*CFA + 29.565*(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*CFA + 29.565*(Nbr+1) (per dwelling unit) where: CFA = conditioned floor area Nbr = number of bedrooms
Internal Gains:	IGain = 17,900 + 23.8*CFA + 4104*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

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*Ndu + 10*Nbr where Ndu = 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 ft² 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.