

ENERGY STAR Qualified Modular Homes Compliance Procedures for Plants and Builders

In 2008, the U.S. Environmental Protection Agency (EPA) designated the Systems Building Research Alliance (SBRA) as the national Quality Assurance Provider (QAP) for ENERGY STAR modular homes, making SBRA responsible for providing ENERGY STAR labels to modular plants and builders and for program quality assurance oversight. SBRA developed, and now administers for EPA, the process used by modular home manufacturing plants and builders to qualify new homes for the ENERGY STAR label.

Under the modular ENERGY STAR compliance process, the modular home manufacturing plant (the “plant”) completes those portions of the ENERGY STAR requirements that can be accomplished in the plant. The plant then ships the home modules, along with information needed to complete the remaining ENERGY STAR features, to the builder/dealer (the “Builder”). The Builder is responsible for installing the remaining ENERGY STAR elements not furnished by the plant and for obtaining third-party verification that the home qualifies for the ENERGY STAR label. The Builder, in effect, purchases a partially completed home that the manufacturer represents as containing specified parts of the overall ENERGY STAR package. The Builder has the responsibility for completing the process and qualifying the home for the ENERGY STAR label.^{1,2,3}

Similarly, quality control is separated into two distinct parts—plant and site—with procedures and protocols appropriate to each. The work of the plant is conducted under the auspices of a Plant Certifier, a specialist in factory building with expertise in energy efficient construction who qualifies the modular plant to build ENERGY STAR.⁴

Verifying ENERGY STAR compliance of the completed home, and specifically the work of the Builder, falls under the purview of a third-party rater (HERS Rater, hereafter referred to as the “Rater”). The Rater inspects and qualifies the homes. Therefore, while the plant is certified to routinely construct homes ready to earn the ENERGY STAR label, there is no equivalent certification for the Builder. Rather, homes are checked in the field by the Rater for compliance with the ENERGY STAR provisions.

Site testing follows a sampling protocol, reflecting the fact that the manufacturer has demonstrated the ability to consistently achieve ENERGY STAR conforming construction in the plant. Table 1 highlights some of the major provisions of the process.

¹ Some state and local programs that provide incentives for ENERGY STAR construction may have additional construction and/or procedural requirements that differ from and/or exceed this national program.

² ENERGY STAR specifications that differ from or that exceed the national program requirements are applicable in some regions, including California, Hawaii and the Pacific Northwest (Washington, Oregon, Idaho and Montana). In Montana and Idaho, either the requirements of the national program or the Pacific Northwest regional program may be used. For details, see the ENERGY STAR website http://www.energystar.gov/index.cfm?c=bop.pt_bop_index.

³ For information on the ENERGY STAR requirements for attached housing, including condominiums, apartments, townhouses and duplexes, see the ENERGY STAR website http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_attached_housing.

⁴ Plants that produce both manufactured and modular homes that are certified to produce ENERGY STAR manufactured homes must be separately certified to produce ENERGY STAR modular homes.

Table 1 Major provisions of the ENERGY STAR program for modular homes

Provision	Requirement
PLANT COMPLETED	
Certification	<ul style="list-style-type: none"> ▪ Conducted by third-party Plant Certifier
Labeling	<ul style="list-style-type: none"> ▪ Quality assurance (QA) label applied in the plant
Inspection and testing	<ul style="list-style-type: none"> ▪ Visual inspection (checklist) of all homes by plant QC staff ▪ Semi-annual inspections/tests by third-party Plant Certifier
FIELD COMPLETED	
Certification	<ul style="list-style-type: none"> ▪ Conducted by third-party Rater
Labeling	<ul style="list-style-type: none"> ▪ ENERGY STAR Home label applied to home upon completion
Inspection and testing	<ul style="list-style-type: none"> ▪ Visual inspection (checklist) of all homes by Builder and Rater ▪ Testing by Rater (1 in 7 minimum, plus first 2 homes per Builder)

Responsibilities of the modular Plant and the Plant Certifier

INITIAL CERTIFICATION (ONE TIME)

1. **Retain third-party Plant Certifier:** Plant hires third-party Plant Certifier approved and monitored by the Quality Assurance Provider (QAP).⁵ The Systems Building Research Alliance (SBRA) website (www.research-alliance.org/pages/es_mod.htm) contains a list of approved Certifiers for the Modular Home ENERGY STAR Program and eligibility criteria for new Certifiers. Certifiers must complete and submit to SBRA a *Modular Certifier Application*.⁶
2. **Develop ENERGY STAR package(s):** The plant develops ENERGY STAR compliant designs and specifications based on prescriptive packages provided by the U.S. Environmental Protection Agency (EPA), referred to as Builder Option Packages or BOPs (Appendix A), and/or custom packages that conform to the EPA performance path requirements (Appendix B). The Certifier must approve the plant’s designs and specifications.
3. **Customize verification checklist:** Working with the Certifier, the plant tailors (if necessary) the template *Inspection Checklist for ENERGY STAR Qualified Modular Home* to mirror the specific building practices at the plant and site. The Checklist is the basic document for dividing the ENERGY STAR responsibilities between the plant and the Builder. All ENERGY STAR measures that must be verified are identified on the Checklist, including items resulting from the use of performance packages (instead of BOPs). All mandatory Thermal Bypass items must appear on the Checklist. When completing the Checklist, indicate “n/a” for those items that do not apply to the home.
4. **Approve Checklist:** Plant Certifier reviews and approves the plant’s Checklist, verifying that all ENERGY STAR elements will be completed at the appropriate stage of construction.

⁵ SBRA is the EPA-approved QAP for the alternative modular home ENERGY STAR program.

⁶ All forms and documents are available for download from www.research-alliance.org/pages/es_mod.htm.

5. **Incorporate ENERGY STAR provisions into plant QC process:** The plant incorporates the ENERGY STAR design features, including the thermal bypass items, into the plant's design package, QC and inspection procedures.
6. **Inspect production homes:** Certifier visually inspects ENERGY STAR measures completed in the plant for a minimum of three (3) ENERGY STAR homes on the production line. Inspections must take place in the plant.
7. **Test completed homes:** The Certifier inspects and tests a minimum of three (3) assembled homes. (These do not have to be the same three homes that were inspected in the plant—see 6 above.) The Certifier submits the completed and signed Checklist together with a ***Completion Report for ENERGY STAR Modular Home*** to SBRA. SBRA reviews the documentation and issues the quality assurance (QA) and ENERGY STAR Qualified Home labels and the ENERGY STAR Qualified Home Certificate to the Certifier. The Certifier provides the certificate and labels to the Builder for application to the home, completing the verification process.
8. **Certify plant:** Upon successful completion of the inspections and tests of at least three homes, the Certifier qualifies the plant for routine production of plant-installed portions of the ENERGY STAR requirements and submits a ***Qualification to Produce ENERGY STAR Qualified Modular Homes*** form to SBRA.
9. **Submit partnership agreement:** The plant registers to build ENERGY STAR homes by submitting an ENERGY STAR Partnership Agreement to EPA (www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_join).

ROUTINE PRODUCTION

1. **Order quality assurance (QA) labels:** Following certification, a plant orders QA labels from SBRA using the ***Label Order Form***.

[NOTE: The QA label verifies that the home was constructed in an ENERGY STAR certified modular home plant in accordance with SBRA oversight requirements. The label indicates that part of the ENERGY STAR home qualification process is complete. The home only becomes ENERGY STAR compliant when the blue EPA ENERGY STAR Qualified Home label, obtained by the Rater, is applied in the field.]
2. **Construct and label homes:** The plant builds ENERGY STAR qualified homes as required and applies the QA label inside the home, typically on or near the electrical panel or other easily accessible location. The plant representative verifies that the applicable portions of the Checklist are completed and signs the Checklist and the QA label.
3. **Deliver home:** The plant ships the home to the Builder and provides the Builder with a copy of the signed Checklist.
4. **Conduct routine inspection:** At no greater than six month intervals, the plant Certifier inspects and, at the Certifier's discretion, tests ENERGY STAR production for ongoing conformance with approved specifications and quality control methods. (SBRA may require additional plant inspections by the Certifier based on compliance issues encountered by the Rater in the field.) The Certifier submits a plant inspection report to SBRA.
5. **Remain active:** Plants must complete at least one ENERGY STAR home every 12 months to remain an active ENERGY STAR Partner.

Responsibilities of the Builder and the Rater

- 1. Initial homes (one time):** Builders getting started with ENERGY STAR modular homes follow the steps outlined below with the addition that testing, as described in Step 6 below, is conducted on the first two (2) homes constructed by the Builder.⁷ These homes are not counted as part of the routine sampling (1 in 7 homes). However, homes tested in the field may include those that were part of the plant's qualification process.
- 2. Retain Rater:** The Builder engages a Rater to inspect and/or test completed homes. Any HERS Rater is eligible once they familiarize themselves with the modular procedures. A list of Raters can be found on the SBRA website (www.research-alliance.org).
- 3. Order homes:** The Builder initiates the ENERGY STAR process by ordering a home with ENERGY STAR features from the plant.
- 4. Notify Rater:** Prior to construction, the Builder provides the Rater with home address, construction documents, expected delivery date and construction schedule. The Rater coordinates with the Builder on the inspection schedule. The Rater is required to visually inspect every home at least once during construction. The Rater randomly selects homes such that a minimum of 1 in 7 of all homes completed by the Builder within each 12-month period is tested.
- 5. Install and inspect home:** The Builder provides a copy of the *Inspection Checklist for ENERGY STAR Qualified Modular Home* to the Rater. The Builder completes the home, ensuring completion of all items on the Checklist. The Rater selects the best time to visit the site to inspect as many items on the Checklist as possible. The Rater reviews remaining items with the Builder and completes and signs the Checklist. Raters should attempt to inspect as many critical items as possible but may delegate a Builder's representative to verify and initial up to six (6) Thermal Bypass items. If the Builder verifies any item, they must sign the Checklist. Both the Builder and the Rater complete and sign the *Completion Report for ENERGY STAR Modular Home*.

If any of the inspection results do not meet requirements noted on the Checklist or other program requirements, the Rater follows the non-compliance procedures described below.

- 6. Test representative homes:** The Rater selects representative homes to be tested (a minimum of 1 in every 7 constructed by the Builder). The tests verify that the home meets or exceeds the target performance levels stipulated on the Checklist. Testing includes the following:
 - Conduct an envelope leakage test to confirm conformance to ENERGY STAR requirements.
 - Conduct test to measure duct air leakage to the outside (not required if all ducts and air handling equipment are in conditioned space and envelope has been tested to no more than 3 ACH50 or 0.25 CFM50 per square foot of building envelope⁸).

If any test results do not meet requirements noted on the Checklist, the Rater follows the non-compliance procedures described below.

⁷ The "first two homes tested" requirement can be waived if the Builder provides documentation to the Rater verifying that the Builder has completed at least two ENERGY STAR qualified modular homes under the site-built/previous modular protocols.

⁸ A fresh air ventilation system may be required for homes with this level of leakage.

7. **Submit documentation:** The Rater submits the completed and signed Checklist together with the Completion Report to SBRA. SBRA will review the documentation and issue an ENERGY STAR Qualified Home label and certificate to the Rater.⁹ The Rater provides the Builder with the ENERGY STAR label and certificate, indicating the third-party verification process is complete.¹⁰
8. **Apply ENERGY STAR label:** The Builder applies the blue ENERGY STAR Qualified Home label provided by the Rater inside the home adjacent to the QA label and provides the certificate to the homeowner. This completes the ENERGY STAR process.

Protocol for Addressing Non-Compliance at the Site

If and when a Rater identifies an item of non-compliance during a site inspection or test and if the item of non-compliance is deemed by the Rater to be systemic (relating to routine methods in either site construction or plant production), the Rater is required to take the following actions:

1. After documenting one or more such non-compliance items, the Rater files a ***Completion Report for ENERGY STAR Modular Home*** with SBRA describing the non-compliance and informs the Builder as to any corrective actions required. The home is then repaired and re-tested.
2. Inspect and test the next two homes built by the same Builder. These homes shall ***not*** count toward the 1 in 7 sample test rate. At the discretion of the Rater, the inspection and testing may be limited to the item(s) found deficient on the failed home, but must include the deficient items. If both homes pass, resume standard quality control testing regimen.
3. If one of the additional homes fails, then cease testing and notify SBRA immediately for instructions on how to proceed.
4. If, in the Rater's judgment, continued non-conformance is the result of work by the Builder and is not related to measures implemented by the plant, ENERGY STAR verification can only resume after repeating the two (2) home initial evaluation successfully and the Rater is fully satisfied that all systemic problems have been addressed and the Builder is ready to consistently meet ENERGY STAR requirements.

If continued non-conformance is the responsibility of the plant, construction of ENERGY STAR Qualified Homes can only resume after the plant certification process, including inspection and testing of all relevant items on three homes, has been successfully repeated and demonstrates to the Certifier's full satisfaction that all systemic problems have been addressed and the plant is ready to consistently meet ENERGY STAR requirements.

⁹ The Rater submits documentation and receives labels from the QAP (SBRA), not their HERS provider.

¹⁰ The QAP will track discrepancies and provide feedback to the Certifier regarding field issues that are influenced by factory building methods.

APPENDICES

- A. ENERGY STAR Qualified Homes National Builder Option Package (BOP)
- B. ENERGY STAR Qualified Homes National Performance Path Requirements
- C. ENERGY STAR Qualified Homes Codes & Standards Information



Appendix A. ENERGY STAR Qualified Homes National Builder Option Package

The requirements for the ENERGY STAR Builder Option Package (BOP) are specified in the table below.

To qualify as ENERGY STAR using this BOP, a home must meet the requirements specified, be verified and field-tested in accordance with the HERS Standards by a RESNET-accredited Provider, and meet all applicable codes.

	Hot Climates ¹ (2004 IRC Climate Zones 1,2,3)	Mixed and Cold Climates ¹ (2004 IRC Climate Zones 4,5,6,7,8)
Cooling Equipment (Where Provided)	Right-Sized ² : <ul style="list-style-type: none"> ENERGY STAR qualified A/C (14.5 SEER / 12 EER); <u>OR</u> ENERGY STAR qualified heat pump³ (14.5 SEER / 12 EER / 8.2 HSPF) 	Right-Sized ² : <ul style="list-style-type: none"> 13 SEER A/C; <u>OR</u> ENERGY STAR qualified heat pump³ (14.5 SEER / 12 EER / 8.5 HSPF)
Heating Equipment	<ul style="list-style-type: none"> 80 AFUE gas furnace; <u>OR</u> ENERGY STAR qualified heat pump^{2,3} (14.5 SEER / 12 EER / 8.2 HSPF); <u>OR</u> 80 AFUE boiler; <u>OR</u> 80 AFUE oil furnace 	<ul style="list-style-type: none"> ENERGY STAR qualified gas furnace (90 AFUE); <u>OR</u> ENERGY STAR qualified heat pump^{2,3} (See Note 3 for specifications); <u>OR</u> ENERGY STAR qualified boiler (85 AFUE); <u>OR</u> ENERGY STAR qualified oil furnace (85 AFUE)
Thermostat ³	ENERGY STAR qualified thermostat (except for zones with radiant heat)	
Ductwork	Leakage ⁴ : ≤ 4 cfm to outdoors / 100 sq. ft.; <u>AND</u> R-6 min. insulation on ducts in unconditioned spaces ⁵	
Envelope	<ul style="list-style-type: none"> Infiltration^{6,7} (ACH50): 7 in CZ's 1-2 6 in CZ's 3-4 5 in CZ's 5-7 4 in CZ 8; <u>AND</u> Insulation levels that meet or exceed the 2004 IRC⁸; <u>AND</u> Completed Thermal Bypass Inspection Checklist⁹ 	
Windows	ENERGY STAR qualified windows or better (additional requirements for CZ2 and CZ4) ^{10, 11, 12}	
Water Heater <small>13, 14</small>	Gas (EF): 40 Gal = 0.61 60 Gal = 0.57 80 Gal = 0.53 Electric (EF): 40 Gal = 0.93 50 Gal = 0.92 80 Gal = 0.89 Oil or Gas ¹⁵ : Integrated with space heating boiler	
Lighting and Appliances ^{16, 17}	Five or more ENERGY STAR qualified appliances, light fixtures, ceiling fans equipped with lighting fixtures, water heaters, and/or ventilation fans	

Note: Due to the unique nature of some state codes and/or climates, EPA has agreed to allow regionally-developed definitions of ENERGY STAR in California, Hawaii, and the Pacific Northwest to continue to define program requirements. The States of Montana and Idaho may use either the requirements of the national program or the regionally-developed program in the Pacific Northwest.



Map is for illustrative purposes only and is based on figure N1101.2 from the 2004 International Residential Code (IRC).



Appendix A. ENERGY STAR Qualified Homes National Builder Option Package Notes

1. The appropriate climate zone shall be determined by the 2004 International Residential Code (IRC), Figure N1101.2.
2. Cooling equipment shall be sized according to the latest editions of ACCA Manuals J and S, ASHRAE 2001 Handbook of Fundamentals, or an equivalent procedure. Maximum oversizing limit for air conditioners and heat pumps is 15% (with the exception of heat pumps in Climate Zones 5 - 8, where the maximum oversizing limit is 25%). The following operating conditions shall be used in the sizing calculations and verified where reviewed by the rater:
Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home's location or most representative city for which design temperature data are available; Indoor temperatures shall be 75 F for cooling and 70 F for heating; Infiltration rate shall be selected as "tight", or the equivalent term.
In specifying equipment, the next available size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI standards.
The stated efficiency requirements are aligned with the increased requirements for ENERGY STAR labeled central air conditioners and air-source heat pumps that went into effect as of January 1, 2009. Equipment manufactured before January 1 is still eligible to earn the ENERGY STAR based on the old performance level. Therefore, there will be a transition period when labeled equipment is commercially available at both the old and new performance levels. Builders must transition to equipment meeting these new ENERGY STAR requirements as stocks of equipment qualified at the old performance levels are exhausted.
3. Homes with heat pumps in Climate Zones 4 and 5 must have an HSPF ≥ 8.5 , which exceeds the ENERGY STAR minimum of 8.2 HSPF. Homes with heat pumps in Climate Zones 6, 7, and 8 cannot be qualified using this BOP, but can earn the label using the ENERGY STAR Performance Path requirements. In homes with heat pumps that have programmable thermostats, the thermostat must have "Adaptive Recovery" technology to prevent the excessive use of electric back-up heating.
4. Ducts must be sealed and tested to be ≤ 4 cfm to outdoors / 100 sq. ft. of conditioned floor area, as determined and documented by a RESNET-certified rater using a RESNET-approved or equivalent ASTM-approved testing protocol. Duct leakage testing can be waived if all ducts and air handling equipment are located in conditioned space (i.e., within the home's air and thermal barriers) AND the envelope leakage has been tested to be ≤ 3 ACH50 OR ≤ 0.25 CFM 50 per sq. ft. of the building envelope.
5. EPA recommends, but does not require, locating ducts within the home's conditioned space (i.e., inside the air and thermal barriers), and using a minimum of R-4 insulation for ducts inside the conditioned space to prevent condensation.
6. Envelope leakage must be determined by a RESNET-certified rater using a RESNET-approved testing protocol.
7. To ensure consistent exchange of indoor air, whole-house mechanical ventilation is recommended, but not required.
8. Insulation levels of a home must meet or exceed Sections N1102.1 and N1102.2 of the 2004 IRC. These sections allow for compliance to be determined by meeting prescriptive insulation requirements, by using U-factor alternatives, or by using a total UA alternative. These sections also provide guidance and exceptions that may be used. However, note that the U-factor for steel-frame envelope assemblies addressed in Section N1102.2.4 shall be calculated using the ASHRAE zone method, or a method providing equivalent results, and not a series-parallel path calculation method as is stated in the code. Additionally, Section N1102.2.2, which allows for the reduction of ceiling insulation in space constrained roof/ceiling assemblies, shall be limited to 500 sq. ft. or 20% of ceiling area, whichever is less. In all cases, insulation shall be inspected to Grade I installation as defined in the RESNET Standards by a RESNET-certified rater.
Note that the fenestration requirements of the 2004 IRC do not apply to the fenestration requirements of the National Builder Option Package. Therefore, if UA calculations are performed, they must use the IRC requirements (with the exception of fenestration) plus the fenestration requirements contained in the national BOP. For more information, refer to the "Codes and Standards Information" document.
9. The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label. The Checklist requires visual inspection of framing areas where air barriers are commonly missed and inspection of insulation to ensure proper alignment with air barriers, thus serving as an extra check that the air and thermal barriers are continuous and complete.
10. All windows and skylights must be ENERGY STAR qualified or meet all specifications for ENERGY STAR qualified windows. Windows in Climate Zones 2 and 4 must exceed ENERGY STAR specifications (CZ 2: U-value ≤ 0.55 and SHGC ≤ 0.35 ; CZ 4: U-value ≤ 0.40 and SHGC ≤ 0.45). Visit www.energystar.gov/windows for more information on ENERGY STAR qualified windows.
11. All decorative glass and skylight window area counts toward the total window area to above-grade conditioned floor area (WFA) ratio. For homes with a WFA ratio $>18\%$, the following additional requirements apply:
 - a. In IRC Climate Zones 1, 2, and 3, an improved window SHGC is required, and is determined by:
Required SHGC = $[0.18 / \text{WFA}] \times [\text{ENERGY STAR SHGC}]$
Where the ENERGY STAR SHGC is the minimum required SHGC of the climate-appropriate window specified in this BOP.
 - b. In IRC Climate Zones 4, 5, 6, 7, and 8, an improved window U-Value is required, and is determined by:
Required U-Value = $[0.18 / \text{WFA}] \times [\text{ENERGY STAR U-Value}]$
Where the ENERGY STAR U-Value is the minimum required U-Value of the climate-appropriate window specified in this BOP.



Appendix A. ENERGY STAR Qualified Homes National Builder Option Package Notes

12. Up to 0.75% WFA may be used for decorative glass that does not meet ENERGY STAR requirements. For example, a home with total above-grade conditioned floor area of 2,000 sq. ft. may have up to 15 sq. ft. (0.75% of 2,000) of decorative glass.
13. More efficient water heating equipment can represent a significant opportunity for energy savings and a meaningful way to differentiate ENERGY STAR qualified homes from those with standard equipment. Selecting an ENERGY STAR qualified water heater not only satisfies the Water Heater efficiency requirements, but also counts toward the requirement for five or more ENERGY STAR qualified lighting products or appliances as detailed in the Lighting and Appliances guideline.
14. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use the following equations:
Gas DHW EF $\geq 0.69 - (0.002 \times \text{Tank Gallon Capacity})$; Electric DHW EF $\geq 0.97 - (0.001 \times \text{Tank Gallon Capacity})$.
15. In homes with gas or oil hydronic space heating, water heating systems must have an efficiency ≥ 0.78 EF. This may be met through the use of an instantaneous water heating system or an indirect storage system with a boiler that has a system efficiency ≥ 85 AFUE. Homes with tankless coil hot water heating systems cannot be qualified using this BOP, but can earn the label using the ENERGY STAR Performance Path requirements.
16. Any combination of ENERGY STAR qualified products listed may be installed to meet this requirement. ENERGY STAR qualified ventilation fans include range hood, bathroom, and inline fans. ENERGY STAR qualified lighting fixtures installed in the following locations shall not be counted: storage rooms (e.g., closets, pantries, sheds), or garages. Eligible appliances include ENERGY STAR qualified refrigerators, dish washers, and washing machines. Further efficiency and savings can be achieved by installing ENERGY STAR qualified products, in addition to those required (e.g., additional lighting, appliances, etc.).
17. Efficient lighting fixtures represent a significant opportunity for persistent energy savings and a meaningful way to differentiate ENERGY STAR qualified homes from those meeting minimum code requirements. To learn more about the benefits of increasing the use of efficient fixtures through the installation of the ENERGY STAR Advanced Lighting Package (ALP), refer to www.energystar.gov/alp.

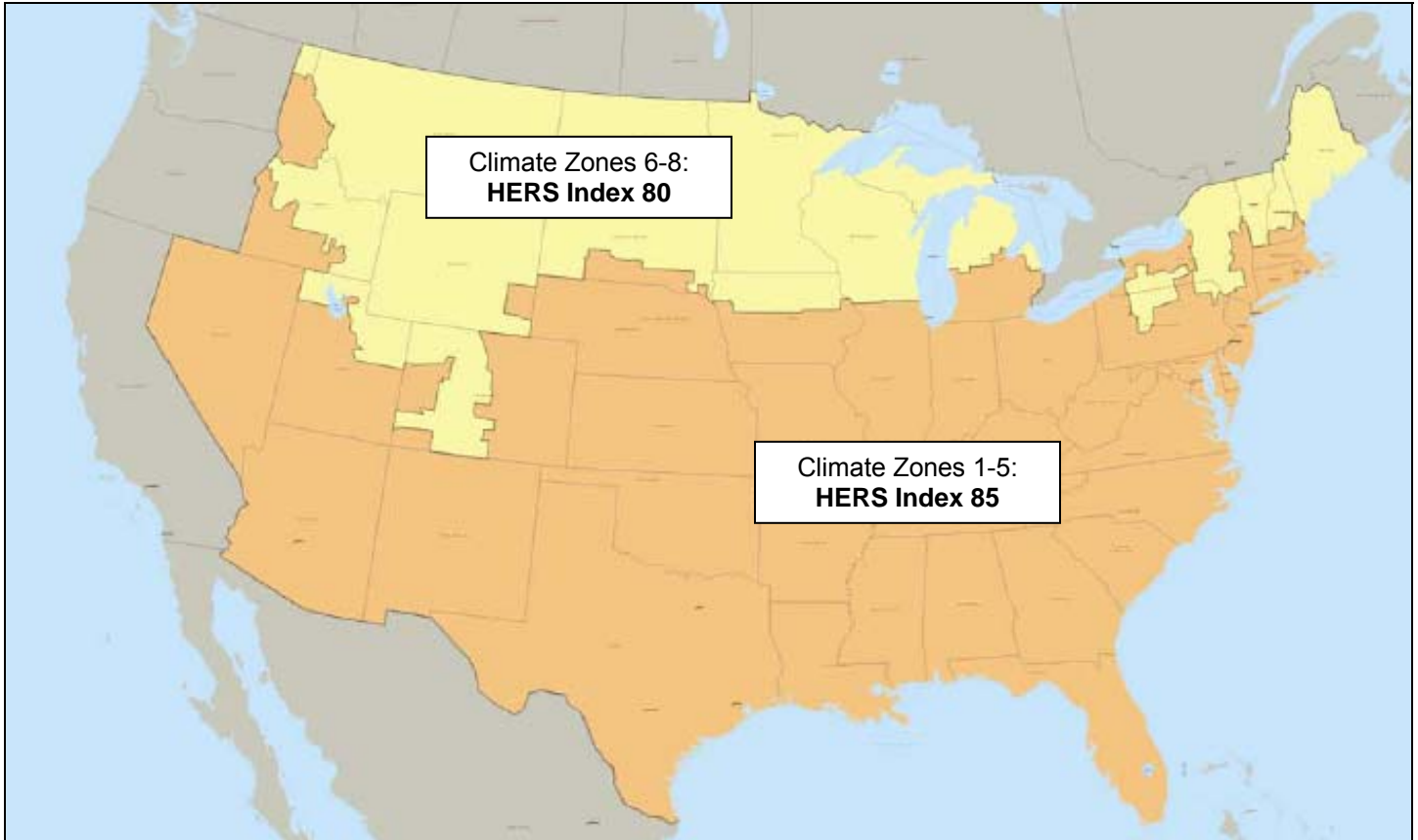


Appendix B. ENERGY STAR Qualified Homes National Performance Path Requirements

ENERGY STAR Performance Requirements:

To qualify as ENERGY STAR, a home must meet the minimum requirements specified below, be verified and field-tested in accordance with the RESNET Standards by a RESNET-accredited Provider, and meet all applicable codes.

Maximum HERS Index Required to Earn the ENERGY STAR¹



Note: Due to the unique nature of some state codes and/or climates, EPA has agreed to allow regionally-developed definitions of ENERGY STAR in California, Hawaii, and the Pacific Northwest to continue to define program requirements. The States of Montana and Idaho may use either the requirements of the national program or the regionally-developed program in the Pacific Northwest.

ENERGY STAR Mandatory Requirements:

Envelope ^{2,3,4}	Completed Thermal Bypass Inspection Checklist
Ductwork ^{5,6}	Leakage \leq 6 cfm to outdoors / 100 sq. ft.
ENERGY STAR Products ¹⁴	<p>Include at least one ENERGY STAR qualified product category:</p> <ul style="list-style-type: none"> ▪ Heating or cooling equipment ^{7,8}; <u>OR</u> <ul style="list-style-type: none"> ▪ Windows ⁹; <u>OR</u> ▪ Water heating equipment; <u>OR</u> ▪ Five or more ENERGY STAR qualified light fixtures ^{10,11}, appliances ¹², ceiling fans equipped with lighting fixtures, and/or ventilation fans ¹³
ENERGY STAR Scoring Exceptions	<ul style="list-style-type: none"> ▪ On-site power generation may not be used to decrease the HERS Index to qualify for ENERGY STAR. ▪ A maximum of 20% of all screw-in light bulb sockets in the home may use compact fluorescent lamps (CFLs) to decrease the HERS Index for ENERGY STAR compliance. CFLs used for this purpose must be ENERGY STAR qualified.



Appendix B. ENERGY STAR Qualified Homes National Performance Path Notes

1. The appropriate climate zone for each building site shall be determined by the 2004 International Residential Code (IRC), Table N1101.2. The HERS Index must be calculated in accordance with the RESNET Mortgage Industry National Home Energy Rating Standards.
2. The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label. The Checklist requires visual inspection of framing areas where air barriers are commonly missed and inspection of insulation to ensure proper alignment with air barriers, thus serving as an extra check that the air and thermal barriers are continuous and complete.
3. Envelope leakage must be determined by a RESNET-certified rater using a RESNET-approved testing protocol.
4. To ensure consistent exchange of indoor air, whole-house mechanical ventilation is recommended, but not required.
5. Ducts must be sealed and tested to be ≤ 6 cfm to outdoors / 100 sq. ft. of conditioned floor area, as determined and documented by a RESNET-certified rater using a RESNET-approved testing protocol. If total duct leakage is ≤ 6 cfm to outdoors / 100 sq.ft. of conditioned floor area, then leakage to outdoors does not need to be tested. Duct leakage testing can be waived if all ducts and air handling equipment are located in conditioned space (i.e., within the home's air and thermal barriers) AND the envelope leakage has been tested to be ≤ 3 ACH50 OR ≤ 0.25 CFM 50 per sq. ft. of the building envelope. Note that mechanical ventilation will be required in this situation.
6. EPA recommends, but does not require, locating ducts within conditioned space (i.e., inside the air and thermal barriers), and using a minimum of R-4 insulation for ducts inside conditioned space to prevent condensation.
7. All cooling equipment, regardless of whether it is used to satisfy the ENERGY STAR products requirement, must be sized according to the latest editions of ACCA Manuals J and S, ASHRAE 2001 Handbook of Fundamentals, or an equivalent computation procedure. Maximum oversizing limit for air conditioners and heat pumps is 15% (with the exception of heat pumps in Climate Zones 5 - 8, where the maximum oversizing limit is 25%). This can be accomplished either by the rater performing the calculations or reviewing documentation provided by the professional contractor or engineer who calculated the sizing (e.g., HVAC contractor). The following operating conditions shall be used in the sizing calculations and verified where reviewed by the rater:

Outdoor temperatures shall be the 99.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home's location or most representative city for which design temperature data are available. Note that a higher outdoor air design temperature may be used if it represents prevailing local practice by the HVAC industry and reflects extreme climate conditions that can be documented with recorded weather data; Indoor temperatures shall be 75⁰ F for cooling; Infiltration rate shall be selected as "tight", or the equivalent term.

In specifying equipment, the next available size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI standards.
8. In homes with heat pumps that have programmable thermostats, the thermostat must have "Adaptive Recovery" technology to prevent the excessive use of electric back-up heating.
9. Where windows are used to meet the ENERGY STAR qualified product requirement, they shall be ENERGY STAR qualified or meet all specifications for ENERGY STAR qualified windows. Additional information can be found at www.energystar.gov/windows.
10. For the purposes of meeting the ENERGY STAR requirement, qualified lighting fixtures in the following locations cannot be counted: storage rooms (e.g., closets, pantries, sheds), or garages.
11. Efficient lighting fixtures represent a significant opportunity for persistent energy savings and a meaningful way to differentiate ENERGY STAR qualified homes from those meeting minimum code requirements. To learn more about the benefits of increasing the use of efficient fixtures through the installation of the ENERGY STAR Advanced Lighting Package (ALP), refer to www.energystar.gov/alp.
12. Eligible appliances include ENERGY STAR qualified refrigerators, dish washers, and washing machines.
13. ENERGY STAR qualified ventilation fans include range hood, bathroom, and inline fans.
14. Further efficiency and savings can be achieved by installing ENERGY STAR qualified products, in addition to those required (e.g., additional lighting, appliances, etc.). For more information, visit www.energystar.gov.



ENERGY STAR Qualified Homes

Insulation Requirements for the National Builder Option Package

The National Builder Option Package requires that the insulation levels of a home meet or exceed Sections N1102.1 and N1102.2 of the 2004 IRC. For example, compliance may be determined by meeting the prescriptive insulation requirements listed by component below. Compliance may also be determined using U-factor alternatives or a total UA alternative as defined in Section N1102.1.2 and Section N1102.1.3. In all cases, insulation shall be inspected to Grade I installation as defined in the RESNET Standards by a RESNET-certified rater. Note that the fenestration requirements of the 2004 IRC do not apply to the fenestration requirements of the National Builder Option Package.

Climate Zone	Ceiling R-Value	Wood Frame Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth	Crawl Space R-Value
1	30	13	13	0	0	0
2	30	13	13	0	0	0
3	30	13	19	0	0	5/13
4 except Marine	38	13	19	10/13	10, 2 ft.	10/13
5 and Marine 4	38	19 or 13+5	30	10/13	10, 2 ft.	10/13
6	49	19 or 13+5	30	10/13	10, 4 ft.	10/13
7 and 8	49	21	30	10/13	10, 4 ft.	10/13

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Best Practices for Sizing Air Conditioners and Heat Pumps

Best practices for sizing air conditioners and heat pumps include:

- Sizing to the manufacturers' performance data;
- Sizing the equipment for the total and latent load capacities;
- Determining the auxiliary heat balance point when sizing heat pumps; and
- Considering both the cooling and heating loads in different climates when sizing heat pumps.

ENERGY STAR Products – Average Energy Savings & Key Product Criteria

Product	Average Energy Savings	Key Product Criteria
Air Conditioner	25%	SEER ≥ 14 ; EER ≥ 11.5
Heat Pump	20%	SEER ≥ 14 ; EER ≥ 11.5; HSPF ≥ 8.2
Furnace	15%	AFUE ≥ 90% (About 15% more efficient than the minimum federal efficiency standards)
Dish Washers	25%	Energy Factor ≥ 0.58: At least 25% more energy efficient than minimum Federal government standards
Clothes Washers	50%	Minimum Modified Energy Factor (MEF) of 1.42
Refrigerator	15%	At least 15% more energy efficient than the minimum Federal government standard (NAECA)



ENERGY STAR Qualified Homes Codes & Standards Information

Product	Average Energy Savings	Key Product Criteria
Windows	ENERGY STAR Home Windows for IRC Climate Zones If IRC Climate Zone is not 2 or 4, then refer to the ENERGY STAR Window Climate Zones below	IRC Climate Zone 4: U-Factor \leq 0.40; SHGC \leq 0.45 IRC Climate Zone 2: U-Factor \leq 0.55; SHGC \leq 0.35; or U-Factor \leq 0.56; SHGC \leq 0.33 U-Factor \leq 0.57; SHGC \leq 0.32 U-Factor \leq 0.58; SHGC \leq 0.31 U-Factor \leq 0.59; SHGC \leq 0.30 U-Factor \leq 0.60; SHGC \leq 0.29 U-Factor \leq 0.61; SHGC \leq 0.28 U-Factor \leq 0.62; SHGC \leq 0.27 U-Factor \leq 0.63; SHGC \leq 0.26 U-Factor \leq 0.64; SHGC \leq 0.25
	Savings vary by climate region (as defined by the ENERGY STAR windows program) and home characteristics See web-site for correct selection of ENERGY STAR windows for building site	Northern Climate Zone: U-Factor \leq 0.35; SHGC \leq Any North/Central Climate Zone: U-Factor \leq 0.40; SHGC \leq 0.55 South/Central Climate Zone: U-Factor \leq 0.40; SHGC \leq 0.40; or U-Factor \leq 0.41; SHGC \leq 0.36 U-Factor \leq 0.42; SHGC \leq 0.31 U-Factor \leq 0.43; SHGC \leq 0.24 Southern Climate Zone: U-Factor \leq 0.65; SHGC \leq 0.40; or U-Factor \leq 0.66; SHGC \leq 0.39 U-Factor \leq 0.67; SHGC \leq 0.39 U-Factor \leq 0.68; SHGC \leq 0.38 U-Factor \leq 0.69; SHGC \leq 0.37 U-Factor \leq 0.70; SHGC \leq 0.37 U-Factor \leq 0.71; SHGC \leq 0.36 U-Factor \leq 0.72; SHGC \leq 0.35 U-Factor \leq 0.73; SHGC \leq 0.35 U-Factor \leq 0.74; SHGC \leq 0.34 U-Factor \leq 0.75; SHGC \leq 0.33 http://www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows
Thermostat	Savings depend on homeowner use	Shipped with a default energy saving program that is capable of maintaining two separate programs and four temperature settings or more for each day
Ventilating Fans	65%	Range hoods (up to 500 cfm): maximum allowable sound level of 2.0 sones; minimum efficacy level of 2.8 cfm/Watt Bathroom fans (10 to 80 cfm): maximum allowable sound level of 2.0 sones; minimum efficacy level of 1.4 cfm/Watt; minimum rated airflow at 0.25 static w.g. 60% of 0.1 static w.g. airflow Bathroom fans (90 to 130 cfm): maximum allowable sound level of 2.0 sones; minimum efficacy level of 2.8 cfm/Watt; minimum rated airflow at 0.25 w.g. 70% of 0.1 static w.g. airflow Bathroom fans (140 to 500 cfm): maximum allowable sound level of 3.0 sones; minimum efficacy level of 2.8 cfm/Watt; minimum rated airflow at 0.25 w.g. 70% of 0.1 static w.g. airflow Light sources must use pin-based fluorescent technology Warranty provided must be a minimum of 1 year
Lighting	66%	http://www.energystar.gov/index.cfm?c=lighting.pr_lighting
Ceiling Fans	Savings depend on homeowner use	http://www.energystar.gov/index.cfm?c=ceiling_fans.pr_ceiling_fans