# SBRA Modular Program Guide

## Procedures for Qualifying Modular Homes for the ENERGY STAR® Label

Systems Building Research Alliance SBRA

ENERGY STAR

# Modular Program Guide

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**Disclaimer**

# Contents

# 1 Program at a Glance

This guide is the Systems Building Research Alliance (SBRA) roadmap for designing, producing and installing energy-efficient ENERGY STAR® modular homes. ENERGY STAR affords the modular housing industry a unique opportunity to extend the advantages of controlled-environment factory production to include exemplary energy performance. An ENERGY STAR qualified modular home is a home built in a factory in compliance with state and/or local codes and the ENERGY STAR guidelines, and that has successfully met all technical and quality control requirements established by the U.S. Environmental Protection Agency (EPA) and the modular program Quality Assurance Provider.

EPA designates third-party organizations to serve as Quality Assurance Providers (QAPs) [1] for ENERGY STAR qualified homes produced and built under guidelines developed by the QAP and approved by EPA. QAPs develop and administer an EPA-approved process to qualify new homes as ENERGY STAR. As such, QAPs are authorized to provide ENERGY STAR labels to qualified homes and are responsible for the oversight and enforcement of all quality assurance requirements related to designing, producing and installing ENERGY STAR qualified homes. QAPs also are responsible for reporting to EPA all homes qualified for the ENERGY STAR label using the QAP's procedures as well as any issues of non-compliance.

The Systems Building Research Alliance (SBRA) has been approved by EPA as a national Quality Assurance Provider (QAP) for ENERGY STAR qualified modular homes. This authorizes SBRA to provide ENERGY STAR labels to certified modular plants and participating builders and to oversee program quality assurance. SBRA developed and now administers an EPA-approved process for modular plants and builders to qualify new homes as ENERGY STAR. This document describes this process. SBRA is responsible for reporting to EPA all modular homes qualified for the ENERGY STAR label using the procedures contained in this guide.

## What is ENERGY STAR?

ENERGY STAR is a nationally recognized, voluntary program designed to identify and promote energy-efficient products, new homes and buildings to consumers and businesses across the United States. Initiated by EPA in 1992, the ENERGY STAR program is administered by EPA and the U.S. Department of Energy. EPA is responsible for establishing energy efficiency guidelines for ENERGY STAR qualified homes.

## What is an ENERGY STAR Qualified Home?

An ENERGY STAR qualified home is significantly more energy efficient in its space heating and cooling and water heating than a comparable standard code home. This increased level of energy efficiency can be met using standard technologies and manufacturing practices. The requirements span four areas of home construction:

1. An energy-efficient building envelope (e.g., effective insulation, tight construction and ENERGY STAR qualified windows).
2. Energy-efficient air distribution (e.g., air-tight, well-insulated ducts).
3. Energy-efficient equipment (e.g., space heating, space cooling and water heating).
4. ENERGY STAR qualified lighting and/or appliances (e.g., refrigerators, dishwashers, washing machines, ventilation fans and ceiling fans equipped with light fixtures).

[1] EPA has established specific qualifications and capabilities that organizations must demonstrate in order to be a designated Quality Assurance Provider (QAP). For more information, visit the ENERGY STAR website: www.energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_builder_manufactured_qualifications.

## Why Participate in ENERGY STAR?

There are at least four good reasons why a plant or builder should consider making the commitment to build ENERGY STAR qualified homes.

1. Recognized brand. The ENERGY STAR label can be a powerful sales tool. ENERGY STAR is a nationally recognized brand, backed and promoted by two federal agencies. Affiliating with ENERGY STAR can differentiate a manufacturer or builder from its peers within the industry and from site-built homes in the same market. Only ENERGY STAR Partners have access to ENERGY STAR logos and labels for qualified homes.
2. Lower customer costs. ENERGY STAR qualified homes, because they are highly energy efficient, have lower monthly operating costs, thereby reducing a homeowner's monthly out-of-pocket expenses and potentially increasing the resale value of the home.
3. Customer satisfaction. The efficiency measures built into an ENERGY STAR qualified home have associated benefits that increase customer satisfaction. These homes are typically more comfortable, durable, quiet and environmentally friendly than non-ENERGY STAR qualified homes.
4. Show the benefits of modular construction. ENERGY STAR offers another opportunity for a modular home manufacturer or builder to demonstrate superior energy performance compared with non-ENERGY STAR qualified site-built homes.

## Key Features of the Program

Modular builders have a distinct advantage in achieving ENERGY STAR levels of performance and the protocols outlined in this document are designed to take advantage of the resource efficiencies inherent in modular building and the quality control practices that already exist in the factory.

Under the modular compliance process, the modular home manufacturing plant (the "plant") completes those portions of the ENERGY STAR requirements that can be accomplished in the factory. The plant then ships the home modules, along with information needed to complete the remaining ENERGY STAR features on site, to the builder/dealer (the "builder"). The builder is responsible for installing the home and completing the remaining ENERGY STAR measures 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.

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 homes that can earn the ENERGY STAR label.

Verifying ENERGY STAR compliance of the completed home, and specifically the work of the builder, is the responsibility of a third-party Home Energy Rater (a HERS Rater, hereafter referred to as the "Rater"). The Rater inspects and qualifies the home. 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 inspected 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 produce homes that comply with the ENERGY STAR requirements. Table 1 highlights some of the major provisions of the process.

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

| Provision | Requirement |
|---|---|
| **PLANT COMPLETED** | |
| Certification | ▪ Conducted by third-party plant Certifier<br>▪ Semi-annual inspections/tests by third-party plant Certifier |
| Inspection and testing | ▪ Visual inspection (checklist) of all homes by plant QC staff |
| Labeling | ▪ Quality Assurance (QA) label applied in the plant by plant staff |
| **FIELD COMPLETED** | |
| Certification | ▪ Conducted by third-party Rater |
| Inspection and testing | ▪ Visual inspection (checklist) of all homes by builder and Rater<br>▪ Testing by Rater (1 in 7 minimum, plus first 2 homes per builder) |
| Labeling | ▪ ENERGY STAR Qualified Home label applied to home upon completion on site |

## Participating in the Program

The following is the sequence of events for qualifying modular homes for the ENERGY STAR label.[2]

1. Certify the plant. To begin building ENERGY STAR modular homes, plants complete a one-time certification conducted by a third-party Certifier. The certification verifies that the plant is familiar with the program requirements. Once completed, the plant can begin producing homes that are ready to be completed on site as ENERGY STAR.

2. Routine plant production of ENERGY STAR homes. Once certified, the plant produces modular homes per the ENERGY STAR technical requirements and quality assurance procedures approved by the Certifier during the plant certification process.

   Each home is accompanied by an **Inspection Checklist** traveler that identifies the items required to qualify the home under the program. The plant's quality control staff verifies completion of the items on the checklist required of the plant, signs the Inspection Checklist and attaches the signed **SBRA Quality Assurance (QA) label** to the home. This completes the plant's responsibilities.

3. Install ENERGY STAR modular homes at the site. The builder is responsible for completing the items on the **Inspection Checklist** required of the builder and arranging for a third-party Rater to verify compliance of the ENERGY STAR items provided in the field.

4. Complete the ENERGY STAR process. When all provisions have been met, the Checklist and a **Modular Home Completion Report** are completed and signed by the Rater and sent to SBRA, the national Quality Assurance Provider for the ENERGY STAR modular home program. SBRA issues the blue **ENERGY STAR® Qualified Home label** to be applied to the home and provides a **Homeowner Certificate**.

## Earning the ENERGY STAR Designation

Modular homes designed and produced in the plant to meet the ENERGY STAR guidelines are only "ENERGY STAR qualified" after they are inspected and verified on site and receive the blue ENERGY STAR Qualified Home label and certificate. Homes cannot be marketed or promoted as "ENERGY STAR labeled" or "ENERGY STAR qualified" until the builder completes the site

[2] Some state and local programs that provide incentives for ENERGY STAR homes may have additional construction and/or procedural requirements that exceed the national program requirements in this guide.

verification process with a HERS Rater.[3] It is the builder's responsibility to arrange for the site inspection by a certified Rater unless another approved arrangement has been made to complete the site verification process.

## Access to Resources

Additional information about ENERGY STAR New Homes—including marketing materials, the ENERGY STAR Partnership Agreement, copies of forms, ENERGY STAR logos and promotional marks, and the ENERGY STAR label—is available on the Web from the Systems Building Research Alliance (www.research-alliance.org) and ENERGY STAR (www.energystar.gov/homes).

[3] Terms such as "ENERGY STAR ready," "ENERGY STAR qualified" or "ENERGY STAR compliant" suggest that the home has already earned the ENERGY STAR label and should not be used to describe partially completed homes.

# 2 Certifying the Plant

## Getting Started: Certifying the Plant

Plants participating in the ENERGY STAR Qualified Modular Home Program are required to complete a one-time certification.[4] Once certified, plants can produce homes that can earn the ENERGY STAR label, monitoring conformance to program guidelines using in-house quality control staff. The certification process assures that the plant has the knowledge, skills and procedures in place to routinely produce homes that comply with the program, and staff committed to maintaining program quality and compliance.

This section provides directions to the Certifier in conducting the plant certification process and discusses the responsibilities of the plant, builder and SBRA. The certification process may be spread out over a number of weeks or months depending on the plant's scheduled production and the builders' scheduled installation and completion of ENERGY STAR modular homes. As shown in Table 2, completion of the certification process involves both the Certifier and various plant staff.

**Table 2 Certification steps and main participants**

| Step | Certifier | Plant staff | | | Builder |
|---|---|---|---|---|---|
| | | Mgmt | Prod/QC | Eng | |
| 1. Retaining a Certifier | | ● | | | |
| 2. Reviewing the ENERGY STAR process | ● | ● | ● | ● | |
| 3. Developing Compliant Designs | ● | | ● | ● | |
| 4. Documenting the ENERGY STAR Requirements | ● | | ● | ● | |
| 5. Building and Inspecting Certification Homes in the Plant | ● | | ● | ● | |
| 6. Educating the Builder | ● | ● | | | ● |
| 7. Installing Certification Homes | ● | ● | ● | | ● |
| 8. Inspecting and Testing Certification Homes in the Field | ● | | | | ● |
| 9. Labeling Completed and Approved Homes | ● | ● | | | ● |
| 10. Issuing the Plant Qualification Form | ● | | | | |
| 11. Submitting an ENERGY STAR Partnership Agreement | | ● | | | ● |

### Step 1. Retaining a Certifier

Plants must hire a Certifier, an independent third party who is responsible for reviewing the plant's building procedures and certifying the plant as capable of conforming to the program requirements. Certifiers must meet certain eligibility criteria and are approved and monitored by SBRA. Certifiers must submit a **Modular Certifier Application** (page 6.4) to SBRA. A list of approved modular plant Certifiers is provided on SBRA's website: www.research-alliance.org/pages/es_mod.htm. Plants are required to have a **Certifier of Record** at all times.

[4] Plants that are certified to produce ENERGY STAR manufactured homes must be separately certified to produce ENERGY STAR modular homes. Manufactured homes are defined as homes built in a factory meeting the federal Manufactured Home Construction and Safety Standards, commonly referred to as the HUD Code.

### Step 2. Reviewing the ENERGY STAR process

The Certifier reviews and verifies that plant staff are familiar with the following four aspects of building ENERGY STAR modular homes.

1. **Overall process and requirements**
   - Role of the Certifier and SBRA in providing program oversight and maintaining quality
   - Responsibilities of the plant and the builder/dealer
   - Completing the **Inspection Checklist for ENERGY STAR Qualified Modular Homes,** hereafter referred to as the "Checklist" (see Step 4)
   - Field testing requirements and role of the field Rater
   - Labeling process: SBRA quality assurance (QA) label applied in the plant and ENERGY STAR Qualified Home label applied in the field
   - Future changes (e.g., new home designs) that would require review by the Certifier
   - Semi-annual in-plant inspections to maintain certification status
   - Resources available on the SBRA website (www.research-alliance.org)
   - Registering with EPA by completing an ENERGY STAR Partnership Agreement (www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_join)
2. **Product design and specifications**
   - ENERGY STAR construction requirements of both the national prescriptive and the national performance compliance paths, including the thermal bypass measures and any prescriptive items required by the path, and if applicable, special requirements such as attached housing or regional program specifications (see Step 3).
   - Measures for complying with the selected path(s). For the performance path, this will require computer analysis approved by the Certifier.
   - Quality control, inspection and verification procedures associated with each path so that the plant has the flexibility of using either or both options.
3. **Production procedure**
   - Proper techniques for ENERGY STAR construction, such as insulation installation, air and duct sealing and the thermal bypass items (refer to the Thermal Bypass Checklist Guide on SBRA's website: www.research-alliance.org/pages/es_mod.htm).
4. **Quality control (QC) process and documentation**
   - Changes in the plant's current QC process and third-party inspection procedures.
   - Integrating the ENERGY STAR requirements into the plant's QC process, including:
     - Incorporating the ENERGY STAR requirements with the traveler accompanying each module.
     - Verifying and signing off on the requirements at each station by the department supervisor, QC manager or other appropriate staff as per the plant's third-party approved QC practices.
     - Procedures for completing the Inspection Checklist.

### Step 3. Developing Compliant Designs

With guidance from the Certifier, the plant develops ENERGY STAR compliant designs and specifications. These are based on the prescriptive path provided by EPA, referred to as Builder Option Packages or BOPs (see page 4.2), and/or custom packages developed using the performance

path (see page 4.5). Once certified, plants may construct homes using either the BOP or performance path specifications.[5]

The BOPs offer a limited range of construction features for meeting the ENERGY STAR requirements. A plant may prefer a different combination of features or use energy saving features not included in the BOPs. The performance path provides this option. Developing a performance path design requires using one of the third-party approved software programs listed on SBRA's website: www.research-alliance.org/pages/es_mod.htm. Either the plant or the Certifier can develop performance-based designs, but these designs and the supporting software analysis must be approved by the plant's Certifier (see page 6.1).

### Step 4. Documenting the ENERGY STAR Requirements

The ENERGY STAR requirements are documented in two ways. First, the plant incorporates the ENERGY STAR specifications, including the Thermal Bypass items, into the plant's design package and production documents.

Second, a new document is created, the **Inspection Checklist**, listing all required ENERGY STAR measures, including mandatory Thermal Bypass items (pages 5.5 to 5.8 contain templates for creating the Checklist). The Checklist is the basic document for dividing the ENERGY STAR responsibilities between the plant and the builder.

The Certifier works with the plant to develop the plant's Checklist. The plant may elect to re-order the checklist items (e.g., organize them by workstation or divide them by plant and builder responsibilities) to facilitate the inspection process, and/or incorporate the Checklist into the existing plant traveler. All ENERGY STAR measures that must be verified and all mandatory Thermal Bypass items must be included on the Checklist. The Certifier reviews and approves the plant's Checklist, verifying that all ENERGY STAR measures will be completed at the appropriate stage of construction. The Checklist must travel with the home to the field to be completed by the builder.

### Step 5. Building and Inspecting Certification Homes in the Plant

The plant builds three (3) ENERGY STAR homes using the Checklist as a guide and signs off on completed Checklist items in the column designated for the Plant QC staff. The Certifier visually inspects and verifies all plant-installed items on the Checklist, including the Thermal Bypass items. The Certifier should pay close attention to those elements that will not be visible in the completed home and any items identified as potential problem areas during the earlier review of the plant's production practices.

Inspection must take place in the plant and should cover all ENERGY STAR requirements, including:

- Insulation installation quality in walls, floors and ceilings
- Air sealing at penetrations in floors, ceiling and walls
- Duct construction and sealing, if applicable
- Insulation and air sealing behind tubs, showers and fireplaces, and in shafts and chases

Line inspections may occur over multiple days depending on the plant production rate and schedule. All required items must be inspected at least once and representative modules from all homes must be inspected at least once. However, all items need not be inspected on all modules/homes. In addition to checking construction compliance, Certifiers must observe the implementation of the ENERGY STAR-related QC items and confirm that it is operating in accordance with the approved plan.

If inspections reveal non-compliance with ENERGY STAR requirements, the plant has the option of either correcting the problem or selecting a new home for inspection (in the latter case, the non-

[5] The performance path analysis must be conducted for each set of unique home parameters (i.e., home design, location, equipment, etc.)

compliant home would not qualify as ENERGY STAR or count toward the three initial homes). Any discrepancies must be corrected and discussed with the plant quality control staff. If, in the Certifier's judgment, the plant is not currently able to produce homes that are ENERGY STAR compliant or to properly implement the QC system, then re-training may be required.

The Certifier completes the appropriate sections of each home's Checklist using the column designated for the Rater. When a measure is verified, the Certifier initials the corresponding box. Field-installed measures will be verified later. When completing the Checklist, indicate "n/a" for items that do not apply to the home. The Checklist is shipped with the homes to the site for testing and final inspection.

### Step 6. Educating the Builder

The plant staff and Certifier together agree on a process for educating builders on their responsibilities under the program. The following three items should be included in discussions with participating builders.

1. **Participant roles**

   Discuss the roles of the plant, Certifier, builder and the builder's third-party Rater in the ENERGY STAR modular home program. Provide a copy of this guide as background.

2. **Division of plant's and builder's responsibilities**

   Review the measures that were installed in the plant and those that need to be completed in the field by the builder. Introduce the Checklist and the builder's responsibility for completing selected items on the Checklist.

3. **Rater's responsibilities**

   Review the responsibilities of the Rater. Recommend that the builder identify a Rater prior to receiving the modules for installation and review with the Rater the field verification and testing protocol.

### Step 7. Installing Certification Homes

The plant can work with one or more builders during this step. The builder(s) installs the certification home(s), ensuring completion of all field-required items on the Checklist, and signs the Checklist.

This step may be completed using a combination of a total of three (3) permanently or temporarily installed homes (i.e., set up outside the factory, at a home show or model center rather than at their final site). For temporarily installed homes, the plant or its agent is acting as the builder of record. This option is subject to meeting the following conditions:

- The Certifier must notify SBRA in advance if planning to inspect and test a temporarily installed home for plant certification purposes.
- All ENERGY STAR requirements are completed on the home(s) including all items on the Checklist and all BOP or performance path construction requirements, with the exception that cooling equipment does not need to be installed.[6]
- The Certifier agrees that the home as set is an accurate representation of the ENERGY STAR features as they would be if installed on the final site.

### Step 8. Inspecting and Testing Certification Homes in the Field

The Certifier[7] verifies compliance in the field of a minimum of three (3) assembled and completed ENERGY STAR modular homes. These do not have to be the same three homes that were inspected in the plant, and may be temporarily installed homes.

[6] If cooling equipment is installed it must comply with the national ENERGY STAR BOP or performance path requirements.

Field verification consists of the following three parts.

1. **Visual inspection of the homes in the field**

   The Certifier verifies proper completion of all field-installed items on the Checklist, including:

   - Marriage line seals
   - Site constructed portions of the home (dormers, conditioned basements, etc.)
   - Builder-provided equipment

   The Certifier selects the best time to visit the site to inspect as many items on the Checklist as possible, but may delegate to a builder's representative responsibility for verifying selected measures. The Certifier completes the remaining sections of each home's Checklist using the column designated for the Rater. When a measure is verified, the Certifier initials the corresponding box. The Certifier fills in a **Modular Home Completion Report** (hereafter referred to as the "Completion Report") for each home.

   If any of the inspection results do not meet the program requirements, the Certifier instructs the builder or the plant (as applicable) as to the required corrective measures and re-inspects the home after corrections are made. If the deficiencies are related to plant-constructed items, the Certifier decides on the appropriate course of action and re-inspects the plant process.

2. **Test homes in the field**

   The Certifier conducts the following pressurization tests on the three homes inspected in the field to verify that the homes meet or exceed the target performance levels.

   - An envelope air infiltration test; and,
   - A test to determine duct air leakage to the outside. This test is not required if all ducts and air handling equipment are within the conditioned space and the envelope has been tested to no more than 3 ACH50 or 0.25 CFM50 per square foot of building envelope. Note that a fresh air ventilation system will be required in this situation.

   If any of the test results do not meet requirements noted on the Checklist, the Certifier instructs the builder or the plant (as applicable) as to the required corrective measures. The home is re-tested after repairs have been made. If the deficiencies are related to plant-constructed items, the Certifier determines the appropriate course of action and re-inspects the plant process.

3. **Debrief on field inspections and tests**

   To provide feedback to plant management regarding the results of the field inspections and tests, the Certifier provides a brief written report(s) containing the results of field tests and a description of any ENERGY STAR-related installation or construction deficiencies (observed during inspections) and an explanation of remedial actions taken.

### Step 9. Labeling Completed and Approved Homes

Upon completion of the field verification process of the initial three plant certification homes, the Certifier submits the completed and signed Checklist together with a Completion Report and the application fees to SBRA, the national Quality Assurance Provider for the ENERGY STAR modular home program. SBRA reviews the documentation submitted by the Certifier and issues the maroon **SBRA Quality Assurance (QA) label,** the blue **ENERGY STAR® Qualified Home label** and the **Homeowner Certificate** to the Certifier. (Once certified, the plant obtains the QA labels from SBRA

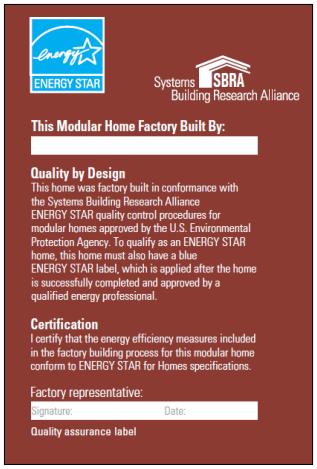
[7] The Certifier may designate a local certified HERS Rater to act as their field representative for the purpose of conducting on-site inspections and tests on the three plant certification homes. However, all documentation must be reviewed, approved and submitted to SBRA by the Certifier. During routine production, field inspections and tests are the responsibility of the Rater.

and applies labels to a module in the plant. The Rater obtains the blue ENERGY STAR label and home certificate from SBRA upon completion of the field verification process.)

The Certifier signs the QA label and provides both labels to the builder to apply to the home, completing the verification process. The labels should be placed on or near the electrical panel box or other readily visible location. The certificate is provided to the homeowner(s). This may be done for each home as completed and need not wait until all three certification homes are complete.

If a temporarily installed home passes all inspections and tests, SBRA will provide the QA label only for attachment to the home. When the home is installed on its final site, the builder's Rater should file an additional Completion Report noting that it was a re-installed home and remitting the field report processing and home certificate fee only. SBRA will provide the blue ENERGY STAR Qualified Home label and certificate only when the home has been installed on its final site and re-inspected (and tested if required) by the builder's Rater.


**EPA ENERGY STAR® Qualified Home Label**




**SBRA QA Label**

### Step 10. Issuing the Plant Qualification Form

Upon successful completion of the inspections and tests of at least three (3) homes, including application of both labels to the homes, the Certifier qualifies the plant for routine production of ENERGY STAR homes and submits a **Modular Plant Qualification** form to SBRA (see page 6.5) and provides a copy to the plant.

### Step 11. Submitting an ENERGY STAR Partnership Agreement

After certification, the plant registers with the U.S. EPA by completing an ENERGY STAR Partnership Agreement online at: www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_join.[8]

## Maintaining the Plant's Certification Status

Within six months of completion of the plant's certification, and every six months thereafter, the Certifier must inspect the plant and, at the Certifier's discretion, tests homes to ensure continuing compliance with ENERGY STAR specifications and quality control methods.[9] This semi-annual checkup provides plants and Certifiers the opportunity to review any changes in the national or regional program requirements and the plant's construction practices, quality assurance or inspection procedures, as well as address any systemic issues related to the plant's responsibilities that have been encountered by Raters in the field.

Any changes proposed by the plant that materially affect the ENERGY STAR construction, inspection or verification process must be reviewed and approved by the Certifier in order for the plant to maintain its certification status. This includes substantive changes to ENERGY STAR designs (BOP or performance path), the plant's quality assurance and inspection procedures, or the plant's Checklist.

[8] Partners must complete at least one ENERGY STAR qualified home every 12 months to maintain their "active" ENERGY STAR Partner status. Only "active" Partners are listed on the ENERGY STAR Partner Locator on the Web and can use the ENERGY STAR logo to promote ENERGY STAR qualified homes.

[9] SBRA may require additional plant inspections by the Certifier based on compliance issues encountered by the Rater or homeowners in the field.

### Step 1. Review Documentation and Proposed Changes

Prior to the visiting the plant, the Certifier coordinates with the plant and SBRA and review the following:

- Completed Checklists and Completion Reports to identify any systemic compliance discrepancies that may require changes to be implemented in the plant's production or quality control procedures. Certifiers may request copies of documentation for completed and qualified homes from SBRA.
- Any proposed changes to the plant's product designs and specifications, Checklist, or production and quality control procedures.
- The plant's process for educating builders on their responsibilities under the program.

### Step 2. Conduct In-Plant Inspection

The Certifier observes the plant's production practices and quality control procedures at various stages of the home production process, including completion of the Checklist by plant staff.

For a minimum of one (1) ENERGY STAR home on the production line, the Certifier visually inspects and verifies all plant-installed items on the Checklist, paying particular attention to the Thermal Bypass items and any items identified as problem areas during the documentation review for completed homes. Inspections must take place in the plant and should cover all ENERGY STAR requirements, including:

- Insulation installation quality in walls, floors and ceilings
- Air sealing at penetrations in floors, ceiling and walls
- Duct construction and sealing, if applicable
- Insulation and air sealing behind tubs, showers and fireplaces, and in shafts and chases

If areas of non-compliance are discovered during the in-plant inspection, the Certifier will recommend corrective actions to the plant and inspect an additional ENERGY STAR home on the production line, ensuring compliance with all ENERGY STAR requirements. If non-compliance is found in the second home, the plant must cease all production of homes that can earn the ENERGY STAR label and the Certifier must notify SBRA. SBRA will provide recommended corrective actions, which may include requiring re-certification of the plant, and notify EPA.

### Step 3. Report Findings to SBRA

Following the inspection, the Certifier provides a brief report to the plant and to SBRA summarizing the inspection results. At a minimum, the following items must be included in the report:

- Certifier company and inspector name
- Plant company name, city and state
- Summary of inspection process and results, including a brief description of any required modifications to the plant's current practices
- Date of in-plant inspection and signature of Certifier

The Certifier initials and dates the completed Checklist for the home observed on the production line and submits a copy to SBRA along with the semi-annual inspection report.

# 3 Routine Production

## Routine Production of ENERGY STAR Modular Homes

Routine compliance is a continuation of the process started with plant certification, with one important change: compliance in the field is checked by a Rater hired by the builder. The steps for routinely building ENERGY STAR homes, including the responsibilities of the plant, builder, Rater and SBRA, are described below.

### Step 1. Obtaining QA Labels

Once certified, the plant orders **Quality Assurance (QA)** labels from SBRA. SBRA will confirm that the plant is certified and process the label order. The label order form is available on SBRA's website: www.research-alliance.org/pages/es_mod.htm.

**NOTE:** The **QA label** verifies that the home was constructed in a certified modular home plant in accordance with ENERGY STAR program and SBRA oversight requirements. The label indicates that the plant's part of the ENERGY STAR home qualification process is complete. The home only becomes ENERGY STAR qualified when the blue EPA **ENERGY STAR® Qualified Home label**, obtained by the Rater upon home completion, is applied to the home in the field.

### Step 2. Producing and Labeling Homes in the Plant

The plant builds homes per the ENERGY STAR requirements and procedures and applies the QA label inside the home, typically on or near the electrical panel or other readily visible location. The plant representative verifies that the applicable portions of the Checklist are completed and signs the Checklist and the QA label. When completing the Checklist, indicate "n/a" for items that do not apply to the home.

### Step 3. Retaining a Rater

Builders must hire a Rater, an independent third party who is responsible for checking that the home conforms to the program requirements. A national list of certified Raters can be found on the Web at: www.resnet.us/trade/find-raters-auditors. Raters are eligible to qualify ENERGY STAR modular homes once they review the requirements and procedures in this guide and complete a **Modular Rater Application** (see page 6.6). A list of Raters qualified to inspect and test modular homes is provided on SBRA's website: www.research-alliance.org/pages/es_mod.htm.

### Step 4. Ordering Homes that can Earn the ENERGY STAR Label

The builder initiates the process of constructing an ENERGY STAR modular home by ordering a modular home from a certified plant. The home must have a QA label to earn the ENERGY STAR label. A list of plants that have been certified to produce ENERGY STAR modular homes is provided on SBRA's website: www.research-alliance.org/pages/es_mod.htm.

### Step 5. Delivering Homes with Checklist

The plant ships the home to the builder and provides the builder with a copy of the partially completed Checklist. The Checklist should be signed by the plant and ready to be completed by the builder and the Rater. The plant should retain a copy of the Checklist.

### Step 6. Completing Homes and Notifying the Rater

Prior to delivery of the home to the site, the builder informs the Rater of the pending project, providing the home address, construction documents, the Checklist and expected delivery date and construction schedule. The builder and Rater establish a schedule for visiting the site to inspect and verify as many items on the Checklist as possible. The Rater is required to visually inspect every home at least once during construction. The builder installs the home, completing all of the required field-installed items on the Checklist.

### Step 7. Inspecting and Testing Homes

The Rater inspects each home and reviews and completes the Checklist. Raters should attempt to inspect as many critical items as possible but may delegate to a builder's representative responsibility for verifying any remaining items. Both the builder and the Rater sign the completed Checklist.

For one (1) in every seven (7) homes completed by a builder within each 12-month period, and for a minimum of one (1) home in each 12-month period in which the builder completed an ENERGY STAR qualified modular home, the Rater also conducts the following pressurization tests to verify that the home meets or exceeds the target performance levels indicated on the Checklist:

- An envelope air infiltration test; and,
- A test to determine duct air leakage to the outside. This test is not required if all ducts and air handling equipment are within the conditioned space and the envelope has been tested to no more than 3 ACH50 or 0.25 CFM50 per square foot of building envelope. Note that a fresh air ventilation system will be required in this situation.

Additionally, Raters must conduct these tests on the first two (2) homes constructed by each builder under these modular protocols. These homes are not counted as part of the routine sampling (1 in 7 homes), but may include homes that were part of the plant's certification process.

If a builder completes an ENERGY STAR qualified home after their partnership status has become "inactive" (i.e., the builder does not complete at least one ENERGY STAR qualified home in a 12-month period), the Rater must conduct the pressurization tests on the builder's next home to reinstate the builder's "active" status. This home may be counted as part of the routine sampling (1 in 7 homes).

If any test results do not meet the requirements noted on the Checklist, the Rater follows the non-compliance procedures described on page 6.3.

### Step 8. Reporting Homes to SBRA

The Rater finalizes and signs the **Modular Home Completion Report.** If the home complies with the program requirements, the Rater submits the Checklist and Completion Report along with the builder's report processing fee to SBRA. The Rater also provides a copy of the completed Checklist and Completion Report to the builder. Processing fees are provided on SBRA's website: www.research-alliance.org/pages/es_mod.htm.

**NOTE:** Some state or local programs that provide incentives for ENERGY STAR construction may have additional construction and/or procedural requirements that exceed the national program requirements outlined in this guide. If required for an incentive, Raters inspecting modular homes for the ENERGY STAR label under a state-sponsored program should report homes to their rating Provider as usual. All other modular homes produced and verified via the protocols outlined in this guide should be reported to SBRA only and not to the rating Provider.


ENERGY STAR

An ENERGY STAR ©Qualified Home

This certifies that the home built at

**323 Decatur Street, Bloomington, MN 55425**

by Brunner Big Builders

and verified by Energy Rater Inc

meets ENERGY STAR guidelines for energy efficiency as established by the U.S. Environmental Protection Agency.

ENERGY STAR qualified homes protect the environment by using less energy.

April 3, 2009

David Lee
Director
ENERGY STAR Residential Programs

Sam Rashkin
Director
ENERGY STAR for New Homes

www.energystar.gov

**Sample Homeowner Certificate**

### Step 9. Applying Labels to Homes and Providing Certificate to Homeowners

SBRA reviews and approves the Completion Report and issues an **ENERGY STAR Qualified Home label** and **Homeowner Certificate** to the Rater. The Rater provides the label and certificate to the builder. The builder applies the label to the home adjacent to the SBRA QA label and provides the certificate to the homeowner(s). This completes the home verification process.

Partners must complete at least one ENERGY STAR qualified home every 12 months to maintain their "active" ENERGY STAR Partner status. Only "active" Partners are listed on the ENERGY STAR Partner Locator on the Web and can use the ENERGY STAR logo to promote ENERGY STAR qualified homes and their ENERGY STAR partnership.

# 4 Design and Construction Requirements

## Compliance Options

This section contains the specifications and requirements for the two compliance options for ENERGY STAR modular homes: the **National Builder Option Package, or BOP** (pages 4.2 to 4.4) and the **National Performance Path** (pages 4.5 and 4.6). Insulation requirements, HVAC sizing best practices and key ENERGY STAR qualified product criteria for both options are explained further in the **Codes and Standards Information** (pages 4.7 and 4.8). The ENERGY STAR guidelines (BOP and Performance Path) and Codes and Standards Information are established by EPA and included in this document for reference purposes.

## Special Considerations

There are separate ENERGY STAR guidelines for attached housing and for certain regions.

1. **Attached Housing**

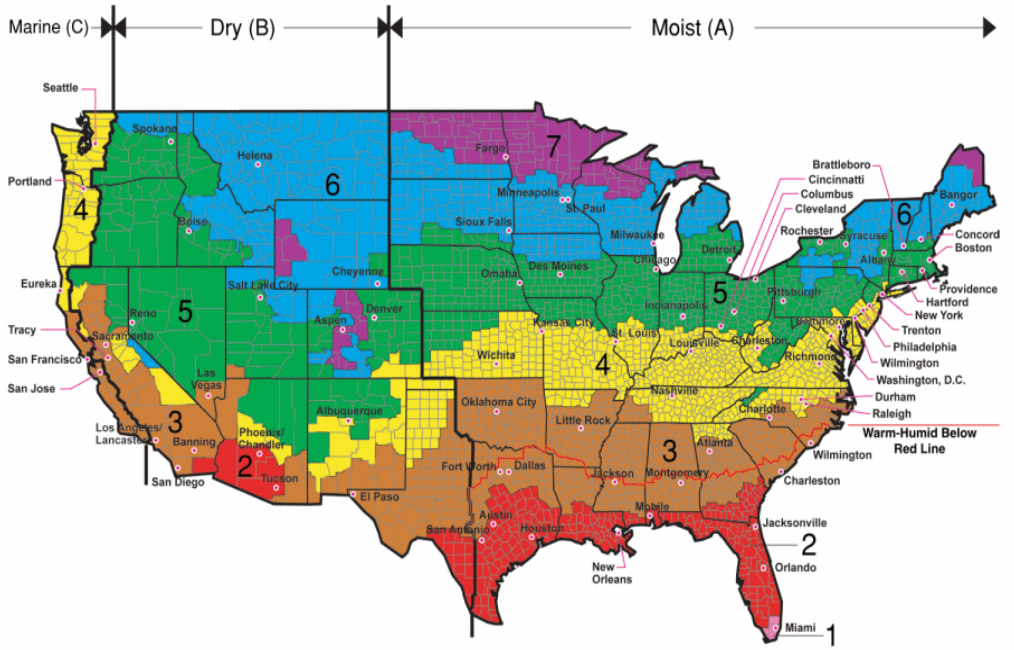
   Attached housing is defined as one dwelling that shares a common floor, ceiling or wall with one or more adjacent dwellings (e.g., condominiums, apartments, townhouses and duplexes). For more information on qualifying attached housing, see the ENERGY STAR website: www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_attached_housing.

2. **Regional Specifications**

   ENERGY STAR specifications that differ from or that exceed the national program requirements are required in some regions, including California, Florida, South Texas, 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 more information on regional guidelines, see the ENERGY STAR website: www.energystar.gov/index.cfm?c=bop.pt_bop_index.

Additionally, some state and local programs that provide incentives for ENERGY STAR homes may have construction and/or procedural requirements that exceed the national program guidelines.

**2004 IECC/IRC Climate Zones**



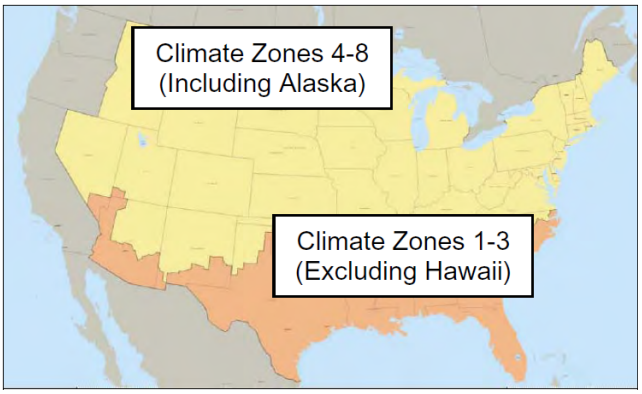

**Zone 1 includes:** Hawaii, Guam Puerto Rico and the Virgin Islands. **All of Alaska in Zone 7 except for the following Boroughs in Zone 8:** Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Artic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk

# ENERGY STAR® Qualified Homes
# National Builder Option Package

To qualify as ENERGY STAR using this **Builder Option Package (BOP)**, a home must meet the requirements specified in the table below and be field-verified in accordance with the HERS Standards and SBRA's modular compliance procedures. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the home to be built.[1]

| | **Hot Climates**[2] (2004 IRC Climate Zones 1,2,3) | **Mixed and Cold Climates**[2] (2004 IRC Climate Zones 4,5,6,7,8) |
|---|---|---|
| **Cooling Equipment** (Where Provided) | Right-Sized[3]:<br>▪ ENERGY STAR qualified A/C *(14.5 SEER / 12 EER)*; OR<br>▪ ENERGY STAR qualified heat pump[4] *(14.5 SEER / 12 EER / 8.2 HSPF)* | Right-Sized[3]:<br>▪ 13 SEER A/C; OR<br>▪ ENERGY STAR qualified heat pump[4] *(14.5 SEER / 12 EER / 8.5 HSPF)* |
| **Heating Equipment** | ▪ 80 AFUE gas furnace; OR<br>▪ ENERGY STAR qualified heat pump[3,4] (*14.5 SEER / 12 EER / 8.2 HSPF*); OR<br>▪ 80 AFUE boiler; OR<br>▪ 80 AFUE oil furnace | ▪ ENERGY STAR qualified gas furnace *(90 AFUE)*; OR<br>▪ ENERGY STAR qualified heat pump[3,4] *(See Note 3 for specifications)*; OR<br>▪ ENERGY STAR qualified boiler *(85 AFUE)*; OR<br>▪ ENERGY STAR qualified oil furnace *(85 AFUE)* |
| **Thermostat**[4] | Programmable thermostat (except for zones with radiant heat) | |
| **Ductwork** | ▪ Leakage[5] ≤ 4 cfm to outdoors / 100 sq. ft. AND<br>▪ R-6 minimum insulation on ducts in unconditioned spaces[6] | |
| **Envelope** | ▪ Infiltration[7,8] (ACH50): 7 in CZ's 1-2 \| 6 in CZ's 3-4 \| 5 in CZ's 5-7 \| 4 in CZ 8; AND<br>▪ Insulation levels that meet or exceed the 2004 IRC[9]; AND<br>▪ Completed Thermal Bypass Inspection Checklist[10] | |
| **Windows** | Windows that meet or exceed Version 4.0 of the ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights (additional requirements for CZ 2 & 4)[11,12,13] | |
| **Water Heater**[14,15] | Gas (EF): 40 Gal = 0.61 \| 60 Gal = 0.57 \| 80 Gal = 0.53<br>Electric (EF): 40 Gal = 0.93 \| 50 Gal = 0.92 \| 80 Gal = 0.89<br>Oil or Gas[16]: Integrated with space heating boiler | |
| **Lighting and Appliances**[17,18] | 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, Florida, South Texas 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).

# ENERGY STAR® Qualified Homes
# National Builder Option Package (BOP) Notes

1. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, EPA offers the following guidance:
    a. In cases where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;
    b. In cases where overlapping requirements conflict with a requirement of these ENERGY STAR guidelines (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these guidelines shall not be met. Furthermore, qualification shall still be allowed if the rater has determined that no equivalent option is available that could meet the intent of the conflicting requirement of these ENERGY STAR guidelines (e.g., switching from exterior to interior slab edge insulation).
2. The appropriate climate zone shall be determined by the 2004 International Residential Code (IRC), Figure N1101.2.
3. 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.
4. 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 in all Climate Zones with heat pumps that have programmable thermostats, the thermostat must have "Adaptive Recovery" technology to prevent the excessive use of electric back-up heating.
5. 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. Note that mechanical ventilation will be required in this situation.
6. 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.
7. Envelope leakage must be determined by a RESNET-certified rater using a RESNET-approved testing protocol.
8. To ensure consistent exchange of indoor air, whole-house mechanical ventilation is recommended, but not required.
9. 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.

10. The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label.
11. Window performance levels must meet or exceed ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights—Version 4.0, with additional requirements for climate zones 2 and 4. Refer to the county-level BOPs on EPA's Web site for the specific window performance levels required in each county of the country. Additional information about Version 5.0 of the program requirements for windows, which is more stringent and offers additional savings, can be found at www.energystar.gov/windows.
12. 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 / WFA] x [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 / WFA] x [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.*
13. 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.
14. More efficient water heating equipment represents a significant opportunity for energy savings and a meaningful way to differentiate ENERGY STAR qualified homes from those with standard equipment. 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.
15. To determine domestic hot water (DHW) EF requirements for additional tank sizes, use the following equations:

    **Gas DHW EF ≥ 0.69 – (0.002 x [Tank Gallon Capacity])**

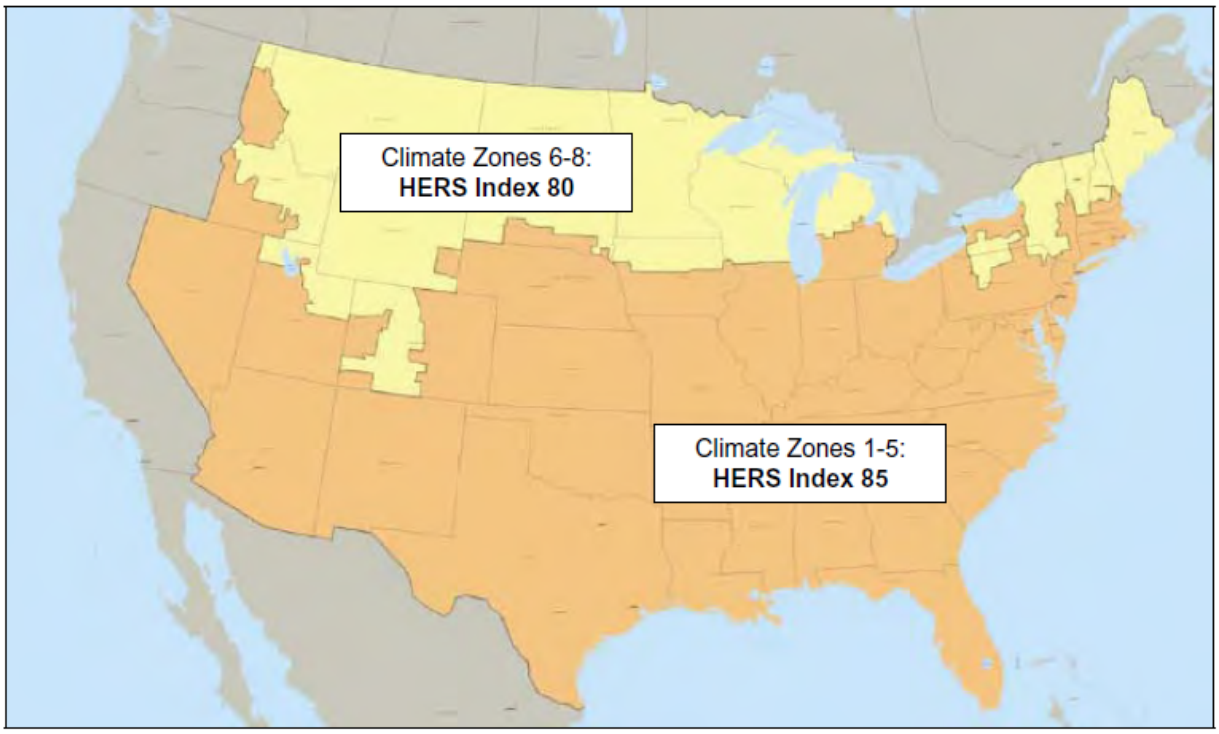
    **Electric DHW EF ≥ 0.97 – (0.001 x [Tank Gallon Capacity])**
16. In homes with gas or oil hydronic space heating, water heating systems must have an efficiency ≥ 0.78 EF. This may be met through the use of an instantaneous water heating system or an indirect storage system with a boiler that has a system 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.
17. 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.
18. 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.

# ENERGY STAR® Qualified Homes
# National Performance Path

**ENERGY STAR Performance Path Requirements:**

To qualify as ENERGY STAR, a home must meet the minimum requirements specified below and be field-verified in accordance with the HERS Standards and SBRA's modular compliance procedures. Note that compliance with these guidelines is not intended to imply compliance with all local code requirements that may be applicable to the home to be built.[1]

**Maximum HERS Index Required to Earn the ENERGY STAR**[2]




**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, Florida, South Texas 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:**

<table>
<tr><td>Envelope [3,4,5]</td><td>Completed Thermal Bypass Inspection Checklist</td></tr>
<tr><td>Ductwork [6,7]</td><td>Leakage ≤ 6 cfm to outdoors / 100 sq. ft.</td></tr>
<tr><td>ENERGY STAR Products</td><td>Include at least one ENERGY STAR qualified product category:<br>▪ Heating or cooling equipment [8,9]; OR<br>▪ Windows that meet the following eligibility requirements [10]; OR
<table>
<tr><td>ENERGY STAR Window Zone:</td><td>Southern</td><td>South / Central</td><td>North / Central</td><td>Northern</td></tr>
<tr><td>Window U-value:</td><td>≤ 0.65</td><td>≤ 0.40</td><td>≤ 0.40</td><td>≤ 0.35</td></tr>
<tr><td>Window SHGC</td><td>≤ 0.40</td><td>≤ 0.40</td><td>≤ 0.55</td><td>Any</td></tr>
</table>
▪ Water heating equipment; OR<br>▪ Five or more ENERGY STAR qualified light fixtures, [11,12] appliances,[13] ceiling fans equipped with lighting fixtures, and/or ventilation fans [14]</td></tr>
<tr><td>ENERGY STAR Scoring Exceptions</td><td>▪ On-site power generation may not be used to achieve the HERS Index required to qualify the home.<br>▪ A maximum of 20% of all screw-in light bulb sockets in the home may use compact fluorescent lamps (CFLs) to achieve the HERS index required to qualify the home. CFLs used for this purpose must be ENERGY STAR qualified.</td></tr>
</table>

# ENERGY STAR® Qualified Homes
# National Performance Path Notes

1. Where requirements of the local codes, manufacturers' installation instructions, engineering documents, or regional ENERGY STAR programs overlap with the requirements of these guidelines, follow this guidance:
    a. In cases where the overlapping requirements exceed the ENERGY STAR guidelines, these overlapping requirements shall be met;
    b. In cases where overlapping requirements conflict with a requirement of these ENERGY STAR guidelines (e.g., slab insulation is prohibited to allow visual access for termite inspections), then the conflicting requirement within these guidelines shall not be met. Furthermore, qualification shall still be allowed if the rater has determined that no equivalent option is available that could meet the intent of the conflicting requirement of these ENERGY STAR guidelines (e.g., switching from exterior to interior slab edge insulation).
2. 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.
3. The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label.
4. Envelope leakage must be determined by a RESNET-certified rater using a RESNET-approved testing protocol.
5. To ensure consistent exchange of indoor air, whole-house mechanical ventilation is recommended, but not required.
6. 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.
7. 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.
8. 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 75°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.
9. 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.
10. Where windows are used to meet the ENERGY STAR qualified product requirement, they shall be ENERGY STAR qualified or meet or exceed the listed eligibility requirements listed in this document, which are aligned with the ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights—Version 4.0. To determine the ENERGY STAR window zone assigned to each county of the country, download the applicable county-level BOP on EPA's Web site and refer to the top right corner of the document. Additional information about Version 5.0 of the program requirements for windows, which is more stringent and offers additional savings, can be found at www.energystar.gov/windows.
11. 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.
12. 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.
13. Eligible appliances include ENERGY STAR qualified refrigerators, dish washers, and washing machines.
14. ENERGY STAR qualified ventilation fans include range hood, bathroom, and inline fans.

# ENERGY STAR® Qualified Homes
# Codes and Standards Information

## Insulation Requirements for National Builder Option Package (BOP)

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[1] R-Value | Floor[2] R-Value | Basement Wall[3] R-Value | Slab[4] R-Value & Depth | Crawl Space[2] 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 |

*Reference: 2004 International Supplement to the International Codes. Copyright 2004. Falls Church, Virginia: International Code Council, Inc. Reproduced with permission. All rights reserved. (Excerpted from 2004 IRC Table N1102.1)*

[1] "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. [2] For CZ Marine 4 and CZ 5 through 8, R-30 required or insulation sufficient to fill the framing cavity, R-19 minimum. [3] The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement. [4] R-5 shall be added to the required slab edge R-values for heated slabs.

## 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 Savings & Key Product Criteria

| Product | Average Energy Savings | Key Product Criteria |
|---|---|---|
| **Central Air Conditioners or Heat Pumps** | 14% | Split systems: ≥ 14.5 SEER / ≥ 12 EER / ≥ 8.2 HSPF<br>Single package equipment: ≥ 14 SEER / ≥ 11 EER / ≥ 8.0 HSPF<br>http://www.energystar.gov/index.cfm?c=airsrc_heat.pr_crit_as_heat_pumps |
| **Furnaces** | 15% | Gas furnace: AFUE ≥ 90% ; Oil furnace: AFUE ≥ 85%<br>http://www.energystar.gov/index.cfm?c=furnaces.pr_crit_furnaces |
| **Dishwashers** | 10% | http://www.energystar.gov/index.cfm?c=dishwash.pr_crit_dishwashers |
| **Clothes Washers** | 30% | Minimum Modified Energy Factor (MEF) of 1.8 and<br>Maximum Water Factor (WF) of 7.5<br>http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers |
| **Refrigerators** | 20% | At least 20% more energy efficient than the minimum Federal government standard (NAECA)<br>http://www.energystar.gov/index.cfm?c=refrig.pr_crit_refrigerators |

## ENERGY STAR® Qualified Homes

# Codes and Standard Information

| Product | Average Energy Savings | Key Product Criteria | | |
|---|---|---|---|---|
| **Windows** | ENERGY STAR Home Windows for IRC Climate Zones<br><br>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**<br>≤ 0.40 | **SHGC**<br>≤ 0.45 |
| | | IRC Climate Zone 2: | ≤ 0.55<br>≤ 0.56<br>≤ 0.57<br>≤ 0.58<br>≤ 0.59<br>≤ 0.60<br>≤ 0.61<br>≤ 0.62<br>≤ 0.63<br>≤ 0.64 | ≤ 0.35; or<br>≤ 0.33<br>≤ 0.32<br>≤ 0.31<br>≤ 0.30<br>≤ 0.29<br>≤ 0.28<br>≤ 0.27<br>≤ 0.26<br>≤ 0.25 |
| | Savings vary by ENERGY STAR Window Climate Zone and home characteristics | Northern Climate Zone: | **U-Factor**<br>≤ 0.35 | **SHGC**<br>Any |
| | | North/Central Climate Zone: | ≤ 0.40 | ≤ 0.55 |
| | | South/Central Climate Zone: | ≤ 0.40<br>≤ 0.41<br>≤ 0.42<br>≤ 0.43 | ≤ 0.40; or<br>≤ 0.36<br>≤ 0.31<br>≤ 0.24 |
| | | Southern Climate Zone: | ≤ 0.65<br>≤ 0.66<br>≤ 0.67<br>≤ 0.68<br>≤ 0.69<br>≤ 0.70<br>≤ 0.71<br>≤ 0.72<br>≤ 0.73<br>≤ 0.74<br>≤ 0.75 | ≤ 0.40; or<br>≤ 0.39<br>≤ 0.39<br>≤ 0.38<br>≤ 0.37<br>≤ 0.37<br>≤ 0.36<br>≤ 0.35<br>≤ 0.35<br>≤ 0.34<br>≤ 0.33 |
| | **Note:** More stringent specifications for ENERGY STAR qualified windows went into effect on January 1, 2010. However, ENERGY STAR New Homes will not be required to include windows meeting the new requirements until January 1, 2011. For more information, visit the ENERGY STAR website http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_windows. | | | |
| **Thermostats** | **Note:** As of December 31, 2009, the ENERGY STAR label is no longer available for programmable thermostats. Therefore, ENERGY STAR New Homes may use non-ENERGY STAR programmable thermostats. For more information, see the ENERGY STAR website http://www.energystar.gov/index.cfm?c=archives.thermostats_spec. | | | |
| **Ventilating Fans** | 70% | http://www.energystar.gov/index.cfm?c=vent_fans.pr_crit_vent_fans | | |
| **Lighting** | 75% | http://www.energystar.gov/index.cfm?c=fixtures.pr_crit_light_fixtures | | |
| **Ceiling Fans with lights** | 50% | http://www.energystar.gov/index.cfm?c=ceiling_fans.pr_crit_ceiling_fans | | |

# 5 Inspection and Verification Documents

Meeting the provisions of ENERGY STAR for modular homes is the joint responsibility of the plant and the builder. While many of the required features or components can be completed in the plant, several features of every home will be completed in the field by the builder. Therefore, the plant and builder work together in demonstrating that the home complies with all the requirements to earn the ENERGY STAR label. In most cases, the plant will take the lead in developing the documents that will be used for demonstrating compliance and then assist the builder in understanding the steps to complete the home.

This section contains the primary documents used for inspection and verification of ENERGY STAR modular homes.

The **Modular Home Completion Report** (pages 5.2 to 5.4) is the field verification form completed by the Rater (or the Certifier for plant certification homes) and submitted to SBRA to report qualified homes and to request the ENERGY STAR label and home certificate.

The **Inspection Checklist** (pages 5.5 to 5.8) is the primary document for dividing ENERGY STAR responsibilities between the plant and the builder. It serves several functions, including the following:

- Provides an itemization of the features required by the BOP or Performance Path and the Thermal Bypass inspection items;
- Provides a place for the plant's quality control staff to document compliance with the Thermal Bypass inspection items and either the BOP or Performance Path items; and,
- Provides the builder and the Rater with a record of the items inspected in the plant and a list of the items that are to be completed and verified in the field to meet the ENERGY STAR requirements and qualify the home for the ENERGY STAR label.

During the certification process, the Certifier and plant together develop the plant's Checklist based on the templates provided in this section. The plant may elect to re-order the checklist items (e.g., organize them by workstation or divide them by plant and builder responsibilities) to facilitate the inspection process, and/or incorporate the Checklist into the existing plant traveler. All items required by the compliance option and all mandatory Thermal Bypass items must be included on the Checklist.

Plants should provide the **Instructions for the Builder** (page 5.9) coversheet with the Checklist.

## ENERGY STAR® Qualified Modular Homes

# Modular Home Label Request

## Instructions

To receive the ENERGY STAR label and home certificate, send the **Modular Home Completion Report,** a copy of the completed and signed **Inspection Checklist** and the processing fee to:

**Systems Building Research Alliance**
**1776 Broadway, Suite 2205**
**New York, NY 10019**

Include a check for the applicable processing fee (includes FedEx Ground delivery):

- ❑ **$50 production home** (builder's processing fee for certificate and site label)

***OR***

- ❑ **$150 plant certification home** ($100 for plant QA label plus $50 builder's fee)

Please allow 5 to 7 days for delivery. For FedEx 2-Day delivery, enclose additional **$20** S&H fee.

**Send labels to (check one):**

- ❑ Certifier / Rater Primary Contact
- ❑ Certifier / Rater Field Tester
- ❑ Other:
- ❑ Modular Plant
- ❑ Modular Builder

Company _____ Contact Name _____

Address _____

City _____ State _____ Zip _____

Email _____ Phone _____

**Questions?**

Contact Gwynne Koch, SBRA ENERGY STAR Program Manager, at gkoch@research-alliance.org or 212-496-0900 x12.

OMB Control No. 2060-0586

# ENERGY STAR® Qualified Modular Homes
# Modular Home Completion Report

## 1. CONTACT INFORMATION

**a) Certifier / Rater Primary Contact**

Company | Contact Name

Address

City | State | Zip

Phone | Fax

Email

**b) Field Tester** (if different from primary contact)

Company | Contact Name

Address

City | State | Zip

Phone | Fax

Email

**c) Plant**

Corporate Parent

Plant Name | Contact Name

Plant City | State | Zip

Phone | Fax

Email

**d) Builder**

Company | Contact Name

Address

City | State | Zip

Phone | Fax

Email

**e) Homeowner**

Name

Phone

**f) Home Location**

Address

City | State | Zip

**Was this home tested?** ☐ Yes ☐ No **If No, skip to question 4.** **Home ID:** _____

## 2. HOUSE TIGHTNESS (fill in and check box) *- OR -* HERS Index: _____

**a)** ACH50. **Measured:** _____ (must be **≤ 7.0** in CZ 1-2 | **≤ 6.0** in CZ 3-4 | **≤ 5.0** in CZ 5-7 | **≤ 4.0** in CZ 8) ..... ☐

## 3. DUCT TIGHTNESS (fill in and check ONE) Conditioned sq. ft.: _____

**a)** Duct leakage to outside at **25 pascals**. **Measured:** _____ **cfm / 100 sq. ft.** ..... ☐
(must be **≤ 4 cfm to outdoors / 100 sq. ft.** for national BOP or **≤ 6 cfm to outdoors / 100 sq. ft.** for Performance Path)

***- OR -***

**b)** All ducts and air handling equipment are in conditioned space and envelope leakage tests at **≤ 3 ACH 50 or ≤ 0.25 cfm 50 per sq. ft.** of building envelope. ..... ☐

## 4. QUALITY ASSURANCE (QA) LABEL (must check ONE to pass)

**a)** An SBRA quality assurance (QA) ENERGY STAR Modular Home Label is affixed to the home interior and signed and dated by a factory representative ..... ☐

***- OR -***

**b)** This home is one of the factory's initial three certification homes. The plant QA label will be signed and affixed with the blue ENERGY STAR home site label (see instructions sheet) ..... ☐

## 5. CERTIFIER / RATER EVALUATION (check ONE)

**a)** PASSES: No discrepancies were identified. ..... ☐

**b)** FAILS: Discrepancies are described on the following sheet. ..... ☐

**Signature of Certifier / Rater:** _____ **Date:** _____

EPA Form 5900-189

The government estimates the average time needed to fill out this form is 0.50 hours and welcomes suggestions for reducing this effort. Send comments (referencing OMB Control Number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

**PROBLEMS / DISCREPANCIES AND REMEDIATION ACTIONS** **Home ID:** _____

**Item No.** _____ **Discrepancy** _____

**Remediation** _____

**Item No.** _____ **Discrepancy** _____

**Remediation** _____

**Item No.** _____ **Discrepancy** _____

**Remediation** _____

**Item No.** _____ **Discrepancy** _____

**Remediation** _____

**Item No.** _____ **Discrepancy** _____

**Remediation** _____

OMB Control No. 2060-0586

# ENERGY STAR® Qualified Modular Homes
# Inspection Checklist – National BOP

Home Address: _____

City: _____ State: _____ Zip: _____ Home ID: _____

**Instructions:** Write your initials in each applicable box. If an item does not apply to the home, write "n/a". Raters should attempt to inspect as many critical items as accessible but may delegate a builder's representative to verify any remaining Thermal Bypass items (numbered items on the first page of this checklist) that are not accessible or that already have been verified in the plant. If the builder verifies any item, they must sign the second page of this checklist. Every line must contain at least one set of initials or "n/a".

| Thermal Bypass Item | Inspection Guidelines | Plant QC | Certifier / Rater | |
|---|---|---|---|---|
| | | Pass | Pass | Fail |
| Overall Air Barrier and Thermal Barrier Alignment | **General requirements:**<br>▪ Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under walls adjoining exterior walls or unconditioned spaces (see below). | | | |
| | **All climate zones:** | | | |
| | 1.1 Overall alignment throughout home | _____ | _____ | _____ |
| | 1.2 Garage band joist air barrier (at bays adjoining conditioned space) | _____ | _____ | _____ |
| | 1.3 Attic eave baffles where vents/leakage exist | _____ | _____ | _____ |
| | **Only at Climate Zones 4 and higher:** | | | |
| | 1.4 Slab-edge insulation (Up to 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.) | _____ | _____ | _____ |
| | **Best practices encouraged, not required:** | | | |
| | 1.5 Air barrier at all band joists (Climate Zones 4 and higher) | _____ | _____ | |
| | 1.6 Minimize thermal bridging (e.g., OVE framing, SIPs, ICFs) | _____ | _____ | |
| Walls Adjoining Exterior Walls or Unconditioned Spaces | **General requirements:**<br>▪ Fully insulated wall aligned with air barrier at both interior and exterior, **OR**<br>▪ Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported<br>▪ Continuous top and bottom plates or sealed blocking | | | |
| | 2.1 Wall behind shower/tub | _____ | _____ | _____ |
| | 2.2 Wall behind fireplace | _____ | _____ | _____ |
| | 2.3 Insulated attic slopes/walls | _____ | _____ | _____ |
| | 2.4 Attic knee walls | _____ | _____ | _____ |
| | 2.5 Skylight shaft walls | _____ | _____ | _____ |
| | 2.6 Wall adjoining porch roof | _____ | _____ | _____ |
| | 2.7 Staircase walls | _____ | _____ | _____ |
| | 2.8 Double walls | _____ | _____ | _____ |
| Floors between Conditioned and Exterior Spaces | **General requirements:**<br>▪ Air barrier is installed at any exposed insulation edges<br>▪ Insulation is installed to maintain permanent contact with sub-floor above | | | |
| | 3.1 Insulated floor above garage | _____ | _____ | _____ |
| | 3.2 Cantilevered floor | _____ | _____ | _____ |
| Shafts | **General requirements:**<br>▪ Openings to unconditioned space are fully sealed with solid blocking or flashing and any remaining gaps are sealed with caulk or foam (provide fire-rated collars and caulking where required) | | | |
| | 4.1 Duct shaft | _____ | _____ | _____ |
| | 4.2 Piping shaft/penetrations | _____ | _____ | _____ |
| | 4.3 Flue shaft | _____ | _____ | _____ |
| Attic / Ceiling Interface | **General requirements:**<br>▪ All attic penetrations and dropped ceilings include a full interior air barrier aligned with insulation with any gaps fully sealed with caulk, foam or tape<br>▪ Movable insulation fits snugly in opening and air barrier is fully gasketed | | | |
| | 5.1 Attic access panel (fully gasketed and insulated) | _____ | _____ | _____ |
| | 5.2 Attic drop-down stair (fully gasketed and insulated) | _____ | _____ | _____ |
| | 5.3 Dropped ceiling/soffit (full air barrier aligned with insulation) | _____ | _____ | _____ |
| | 5.4 Recessed lighting fixtures (ICAT labeled and sealed to drywall) | _____ | _____ | _____ |
| | 5.5 Whole-house fan (insulated cover gasketed to the opening) | _____ | _____ | _____ |
| Common Walls Between Dwellings | **General requirements:**<br>▪ Gap between drywall shaft wall (common wall) and structural framing between units is sealed at all exterior boundary conditions | | | |
| | 6.1 Common wall between dwelling units | _____ | _____ | _____ |

# Inspection Checklist – National BOP (Prescriptive Path)

Home ID: _____

| BOP Item | Inspection Guidelines | Plant QC | Certifier / Rater | |
|---|---|---|---|---|
| | | Pass | Pass | Fail |
| **Cooling Equipment** ***(when provided)*** | **General requirements:**<br>**Hot Climates** (2004 IRC Climate Zones 1,2,3) Right-Sized [1]:<br>▪ ENERGY STAR qualified AC (*14.5 SEER / 12 EER*) **OR** ENERGY STAR qualified heat pump (*14.5 SEER / 12 EER / 8.2 HSPF*)<br>**Mixed and cold climates** (2004 IRC Climate Zones 4,5,6,7,8) Right-sized [1]:<br>▪ 13 SEER AC **OR** ENERGY STAR qualified heat pump [2] (*14.5 SEER / 12 EER / 8.5 HSPF*) | _____ | _____ | _____ |
| **Heating Equipment** | **General requirements:**<br>**Hot Climates** (2004 IRC Climate Zones 1,2,3):<br>▪ 80 AFUE gas furnace **OR** 80 AFUE boiler **OR** 80 AFUE oil furnace **OR** ENERGY STAR qualified heat pump *(14.5 SEER / 12 EER / 8.2 HSPF)*<br>**Mixed and Cold Climates** (2004 IRC Climate Zones 4,5,6,7,8):<br>▪ ENERGY STAR qualified gas furnace (90 AFUE) **OR** ENERGY STAR qualified boiler (85 AFUE) **OR** ENERGY STAR qualified oil furnace (85 AFUE) **OR** ENERGY STAR qualified heat pump [2] (*14.5 SEER / 12 EER / 8.5 HSPF*) | _____ | _____ | _____ |
| **Thermostat** | **General requirements:**<br>▪ ENERGY STAR qualified thermostat (except zones with radiant heat) [1] | _____ | _____ | _____ |
| **Ductwork** | **General requirements:** | | | |
| | ▪ Leakage ≤ 4 cfm to outdoors per 100 sq. ft. of conditioned floor area | _____ | _____ | _____ |
| | ▪ Ducts in unconditioned spaces wrapped with R-6 minimum insulation | _____ | _____ | _____ |
| | ▪ All exterior ducts mechanically secured and supported off the ground | _____ | _____ | _____ |
| **Envelope** | **General requirements:** | | | |
| | ▪ Infiltration (ACH50): 7 in CZs 1–2 \| 6 in CZs 3–4 \| 5 in CZs 5–7 \| 4 in CZ 8 | _____ | _____ | _____ |
| | ▪ Insulation levels that meet or exceed the 2004 IRC [1] | _____ | _____ | _____ |
| **Windows** | **General requirements:**<br>▪ ENERGY STAR qualified windows or better (additional requirements in CZ 2 and CZ 4) [1] | _____ | _____ | _____ |
| **Water Heater** [3] | **General requirements:** | | | |
| | ▪ 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 water heating system ≥ 0.78 EF is integrated with space heating boiler [4] | _____ | _____ | _____ |
| **Lighting and Appliances** | **General requirements:**<br>▪ Five (5) or more ENERGY STAR qualified appliances, light fixtures, ceiling fans equipped with lighting fixtures, water heaters and/or ventilation fans are installed, as listed below. [1]<br>1. _____ 4. _____<br>2. _____ 5. _____<br>3. _____ | _____ | _____ | _____ |
| **Marriage Line Seal** | **General requirements:**<br>▪ All vertical and horizontal marriage line areas filled with continuous non-porous insulating gaskets creating a permanent air barrier at joints in the ceiling, walls and floor. Gaskets may be one or two-part systems, including proprietary gaskets, foams, insulation wrapped in poly, or insulation covered by butyl or other long-life tape on one side. No visible signs of gaps or tears are permitted. | _____ | _____ | _____ |
| **Floors over Unconditioned Spaces** | **General requirements:**<br>▪ Air barrier between floor and unconditioned crawlspace is continuous and sealed. | _____ | _____ | _____ |

[1] For more information, see "ENERGY STAR Qualified Homes Codes and Standards Information."

[2] Only applicable to homes in Climate Zones 4 and 5. Homes with heat pumps in Climate Zones 6, 7 and 8 cannot be qualified using the Prescriptive Path (BOP), but can earn the label using the ENERGY STAR Performance Path requirements.

[3] Efficiency ratings not applicable if ENERGY STAR qualified water heater is installed to comply with Lighting and Appliances requirement.

[4] Can use instantaneous water heating system or an indirect storage system with a boiler that has a system efficiency of ≥ 85 AFUE. Homes with tankless coil water heating systems cannot be qualified using the Prescriptive Path (BOP), but can be qualified using the ENERGY STAR Performance Path.

| **Plant QC** | **Rater** | **Builder** |
|---|---|---|
| Company: _____ | Company: _____ | Company: _____ |
| Signature: _____ | Signature: _____ | Signature: _____ |
| Date: _____ Initials: _____ | Date: _____ Initials: _____ | Date: _____ Initials: _____ |

EPA Form 5900-190

The government estimates the average time needed to fill out this form is 0.50 hours and welcomes suggestions for reducing this effort. Send comments (referencing OMB Control Number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

OMB Control No. 2060-0586

# ENERGY STAR® Qualified Modular Homes
# Inspection Checklist – Performance Path

Home Address: _____

City: _____ State: _____ Zip: _____ Home ID: _____

**Instructions:** Write your initials in each applicable box. If an item does not apply to the home, write "n/a". Raters should attempt to inspect as many critical items as accessible but may delegate a builder's representative to verify any remaining Thermal Bypass items (numbered items on the first page of this checklist) that are not accessible or that already have been verified in the plant. If the builder verifies any item, they must sign the second page of this checklist. Every line must contain at least one set of initials or "n/a".

| Thermal Bypass Item | Inspection Guidelines | Plant QC | Certifier / Rater | |
|---|---|---|---|---|
| | | Pass | Pass | Fail |
| **Overall Air Barrier and Thermal Barrier Alignment** | **General requirements:**<br>▪ Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under walls adjoining exterior walls or unconditioned spaces (see below). | | | |
| | **All climate zones:** | | | |
| | 1.1 Overall alignment throughout home | _____ | _____ | _____ |
| | 1.2 Garage band joist air barrier (at bays adjoining conditioned space) | _____ | _____ | _____ |
| | 1.3 Attic eave baffles where vents/leakage exist | _____ | _____ | _____ |
| | **Only at Climate Zones 4 and higher:** | | | |
| | 1.4 Slab-edge insulation (Up to 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.) | _____ | _____ | _____ |
| | **Best practices encouraged, not required:** | | | |
| | 1.5 Air barrier at all band joists (Climate Zones 4 and higher) | _____ | _____ | |
| | 1.6 Minimize thermal bridging (e.g., OVE framing, SIPs, ICFs) | _____ | _____ | _____ |
| **Walls Adjoining Exterior Walls or Unconditioned Spaces** | **General requirements:**<br>▪ Fully insulated wall aligned with air barrier at both interior and exterior, **OR**<br>▪ Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported<br>▪ Continuous top and bottom plates or sealed blocking | | | |
| | 2.1 Wall behind shower/tub | _____ | _____ | _____ |
| | 2.2 Wall behind fireplace | _____ | _____ | _____ |
| | 2.3 Insulated attic slopes/walls | _____ | _____ | _____ |
| | 2.4 Attic knee walls | _____ | _____ | _____ |
| | 2.5 Skylight shaft walls | _____ | _____ | _____ |
| | 2.6 Wall adjoining porch roof | _____ | _____ | _____ |
| | 2.7 Staircase walls | _____ | _____ | _____ |
| | 2.8 Double walls | _____ | _____ | _____ |
| **Floors between Conditioned and Exterior Spaces** | **General requirements:**<br>▪ Air barrier is installed at any exposed insulation edges<br>▪ Insulation is installed to maintain permanent contact with sub-floor above | | | |
| | 3.1 Insulated floor above garage | _____ | _____ | _____ |
| | 3.2 Cantilevered floor | _____ | _____ | _____ |
| **Shafts** | **General requirements:**<br>▪ Openings to unconditioned space are fully sealed with solid blocking or flashing and any remaining gaps are sealed with caulk or foam (provide fire-rated collars and caulking where required) | | | |
| | 4.1 Duct shaft | _____ | _____ | _____ |
| | 4.2 Piping shaft/penetrations | _____ | _____ | _____ |
| | 4.3 Flue shaft | _____ | _____ | _____ |
| **Attic / Ceiling Interface** | **General requirements:**<br>▪ All attic penetrations and dropped ceilings include a full interior air barrier aligned with insulation with any gaps fully sealed with caulk, foam or tape<br>▪ Movable insulation fits snugly in opening and air barrier is fully gasketed | | | |
| | 5.1 Attic access panel (fully gasketed and insulated) | _____ | _____ | _____ |
| | 5.2 Attic drop-down stair (fully gasketed and insulated) | _____ | _____ | _____ |
| | 5.3 Dropped ceiling/soffit (full air barrier aligned with insulation) | _____ | _____ | _____ |
| | 5.4 Recessed lighting fixtures (ICAT labeled and sealed to drywall) | _____ | _____ | _____ |
| | 5.5 Whole-house fan (insulated cover gasketed to the opening) | _____ | _____ | _____ |
| **Common Walls Between Dwellings** | **General requirements:**<br>▪ Gap between drywall shaft wall (common wall) and structural framing between units is sealed at all exterior boundary conditions | | | |
| | 6.1 Common wall between dwelling units | _____ | _____ | _____ |

# Inspection Checklist – Performance Path

Home ID: _____

| Performance Path Item | Inspection Guidelines | Plant QC | Certifier / Rater | |
|---|---|---|---|---|
| | | Pass | Pass | Fail |
| **Performance Index** | All performance path construction specifications have been adhered to and the home has achieved the required performance index.[1]<br>▪ 2004 IRC Climate Zones 1 – 5: Maximum HERS Index 85<br>▪ 2004 IRC Climate Zones 6 – 8: Maximum HERS Index 80 | _____ | _____ | _____ |
| **Ductwork** | **General requirements:** | | | |
| | ▪ Leakage ≤ 6 cfm to outdoors per 100 sq. ft. of conditioned floor area | _____ | _____ | _____ |
| | ▪ Ducts in unconditioned spaces wrapped with R-6 minimum insulation | _____ | _____ | _____ |
| | ▪ All exterior ducts have been mechanically secured and supported off the ground | _____ | _____ | _____ |
| **ENERGY STAR Qualified Products** | **General requirements:**<br>▪ Include at least one (1) of the following ENERGY STAR qualified product categories: [2] | | | |
| | Heating or cooling equipment **OR** Windows **OR** Water heating equipment **OR** Five (5) or more qualified light fixtures, appliances, ceiling fans equipped with lighting fixtures and/or ventilation fans. *Specify:* | _____ | _____ | _____ |
| **Marriage Line Seal** | **General requirements:**<br>▪ All vertical and horizontal marriage line areas filled with continuous non-porous insulating gaskets creating a permanent air barrier at joints in the ceiling, walls and floor. Gaskets may be one or two-part systems, including proprietary gaskets, foams, insulation wrapped in poly, or insulation covered by butyl or other long-life tape on one side. No visible signs of gaps or tears are permitted. | _____ | _____ | _____ |
| **Floors over Unconditioned Spaces** | **General requirements:**<br>▪ Air barrier between floor and unconditioned crawlspace is continuous and sealed. | _____ | _____ | _____ |

[1] 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.

[2] For more information, see "ENERGY STAR Qualified Homes Codes and Standards Information."

| **Plant QC** | **Rater** | **Builder** |
|---|---|---|
| Company: _____ | Company: _____ | Company: _____ |
| Signature: _____ | Signature: _____ | Signature: _____ |
| Date: _____ Initials: _____ | Date: _____ Initials: _____ | Date: _____ Initials: _____ |

EPA Form 5900-192

The government estimates the average time needed to fill out this form is 0.50 hours and welcomes suggestions for reducing this effort. Send comments (referencing OMB Control Number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

# ENERGY STAR® Qualified Modular Homes
# Instructions for the Builder

**To the Plant:** Attach this sheet to the front of the **Inspection Checklist** provided to the builder.

**To the Builder:** This page outlines the steps for completing an ENERGY STAR modular home. This home has been designed and constructed in the plant in compliance with the ENERGY STAR guidelines. The home should have a maroon SBRA Quality Assurance (QA) label provided by the plant,* and will earn the ENERGY STAR label once the home passes a site inspection conducted by a qualified Home Energy Rater (Rater). The builder is responsible for hiring a Rater to complete the required site inspection checklist.

## *Step 1* Complete Partnership Agreement

If not already done, complete an EPA **ENERGY STAR Partnership Agreement** online at www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_join to gain access to ENERGY STAR marketing materials and logos and be listed in the ENERGY STAR Partner Locator on the Web.

## *Step 2* Retain Modular Rater

Retain a HERS Rater qualified to inspect and test homes. A national list of certified Raters can be found on the Web at: www.resnet.us/trade/find-raters-auditors.

Raters that have enrolled in the Modular ENERGY STAR program and are approved to inspect and test modular homes are listed on SBRA's website: www.research-alliance.org/pages/es_mod.htm.

## *Step 3* Review the Inspection Checklist

Review and complete the **Inspection Checklist** provided by the plant. Speak with the plant if you have any questions about completing the form.

## *Step 4* Install Home per Checklist

Coordinate inspections and any required tests with your Rater. Working with the Rater, complete all remaining Checklist items and sign the Checklist. The Rater must submit the completed **Checklist** and a **Modular Home Completion Report** to SBRA to obtain the ENERGY STAR Qualified Home label and Certificate.

## *Step 5* Apply ENERGY STAR Label

Apply the blue ENERGY STAR label provided by the Rater next to the SBRA QA label. The Rater will provide the ENERGY STAR Qualified Home Certificate to you for the homeowner(s).

All documents and forms are available the SBRA website:
www.research-alliance.org/pages/es_mod.htm

***Questions?***

Contact Gwynne Koch, ENERGY STAR Program Manager
Systems Building Research Alliance (SBRA)
212-496-0900 x12 or gkoch@research-alliance.org

* If a plant is undergoing the certification process, the home may not yet have the QA label applied, but will receive one after inspection and testing in the field.

# 6 Resources for Certifiers and Raters

## Plant Certifier

### Responsibilities

The plant Certifier is responsible for reviewing the procedures and methods that the plant plans to employ in building ENERGY STAR modular homes, educating plant personnel on the program, and certifying the plant as conforming to the ENERGY STAR Modular Home program requirements. Although plant certification is a one-time process, the Certifier is responsible for periodically re-inspecting plant procedures and resolving production-related problems if and as they arise. Therefore, the plant is required to have a **Certifier of Record** at all times. Major responsibilities of the Certifier include the following:

1. Plant certification. During plant certification, the Certifier assists the plant in developing compliant designs and construction practices[10]; verifies that an acceptable quality assurance system is in place in the plant; verifies that workers are properly trained in ENERGY STAR requirements; reviews and approves the plant's **Inspection Checklist** (see pages 5.5 to 5.8 for templates); and, inspects and tests certification homes to establish the plant's ability to routinely build compliant homes under the program. The plant certification process is discussed in Section 2. See page 6.5 for the **Modular Plant Qualification Form**.
2. Periodic re-inspections of the plant. At no greater than six month intervals, the Certifier inspects the plant and, at the Certifier's discretion, tests homes to ensure continuing compliance with ENERGY STAR requirements.
3. Problem resolution. When issues are identified by Raters in the field that may have originated in the plant, the Certifier works with the Rater and the plant to resolve the problem and take corrective actions if necessary.

### Qualifications and Eligibility Criteria

Certifiers must have proven experience with plant building methods and expertise in energy efficient building, be familiar with the requirements and procedures contained in this guide and be qualified to conduct testing and diagnostics related to ENERGY STAR compliance. SBRA reviews and approves Certifier credentials. SBRA reserves the right to revoke Certifier credentials at any time and for any reason.

Credentials for Certifiers include all of the following:

- Certified Home Energy Rating System (HERS) Rater or Provider -or- Licensed Engineer or Architect,
- Working knowledge of residential building codes, of the plant production processes, and of the modular home design approval and inspection process,
- Knowledge of modular home design, construction, installation, material use and fabrication,
- Hands-on experience conducting duct and whole-house air leakage measurements,
- Experience and training in the principles of building science and in energy efficiency construction practices,
- Capability to maintain computer records and communicate via email.

Certifiers must complete and submit to SBRA a **Modular Certifier Application** (see page 6.4).

[10] Performance path analysis must be conducted by a certifier HERS Rater or Provider.

## Home Energy Rater (HERS Rater)

### Responsibilities

The Rater is hired by the builder to inspect, test and certify individual factory built ENERGY STAR homes installed and completed by the builder on site. Major responsibilities of the Rater include the following:

1. Visual inspections. The Rater coordinates with the builder on the inspection schedule, visits the site to inspect every home at least once during construction and completes the **Inspection Checklist.** Both the builder and the Rater sign the Checklist.

2. Performance testing. The Rater conducts performance testing on 1 in every 7 homes completed by a builder within each 12-month period, and for a minimum of one (1) home in each 12-month period in which the builder completes an ENERGY STAR qualified modular home, to ensure that the home meets or exceeds the target performance level indicated on the Checklist. If any test results do not meet the requirements on the Checklist or **Modular Home Completion Report**, the Rater follows the non-compliance procedures described below.

   Additionally, the Rater tests the first two (2) homes constructed by a builder under these modular protocols. These two homes are not counted as part of the routine sampling (1 in 7 homes), but may include those homes that were part of the plant's qualification process.

   If a builder completes an ENERGY STAR qualified home after their partnership status has become "inactive" (i.e., the builder does not complete at least one ENERGY STAR qualified home in a 12-month period), the Rater must conduct the pressurization tests on the builder's next home to reinstate the builder's "active" status. This home may be counted as part of the routine sampling (1 in 7 homes).

3. Reporting qualified homes. The Rater submits the completed and signed Checklist and Completion Report to SBRA along with the builder's report processing and home certificate fee. SBRA reviews the documentation and issues the blue ENERGY STAR Qualified Home label and the homeowner's certificate to the Rater to provide to the builder. The builder applies the label to the home and presents the certificate to the homeowner.

   **NOTE:** Some state or local programs that provide incentives for ENERGY STAR construction may have additional construction and/or procedural requirements that exceed the national program requirements outlined in this guide. If required for an incentive, Raters inspecting modular homes for the ENERGY STAR label under a state-sponsored program should report homes to their rating Provider as usual. All other modular homes produced and verified via the protocols outlined in this guide should be reported to SBRA only and not to the rating Provider.

### Qualifications and Eligibility Criteria

Raters must be familiar with the requirements and procedures contained in this guide and have proven skills in reviewing energy efficient building practices, building diagnostics and conducting testing associated with ENERGY STAR compliance. SBRA reviews and approves Rater credentials. SBRA reserves the right to revoke Rater credentials at any time and for any reason.

Credentials for Raters include all of the following:

- Working knowledge of the residential building codes,
- Knowledge of modular home design, construction, installation, material use and fabrication,
- Certified Home Energy Rating System (HERS) Rater.

Raters must complete and submit to SBRA a **Modular Rater Application** (see page 6.6).

## 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 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. The Rater inspects and tests 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, the standard quality control testing regimen resumes.
3. If one of the additional homes fails, the Rater ceases testing and notifies 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.
5. If continued non-conformance is the responsibility of the plant, construction of ENERGY STAR homes can only resume after the plant certification process, including inspection and testing of all relevant items on three (3) homes, has been successfully repeated and demonstrated to the plant Certifier's full satisfaction that all systemic problems have been addressed and the plant is ready to consistently meet ENERGY STAR requirements.

If non-compliance by either the builder or the plant continues after attempts to address the problems have been made, the builder must stop building ENERGY STAR modular homes and the plant must cease production of ENERGY STAR homes under the requirements contained in this guide and SBRA must be notified for further corrective action. SBRA will notify EPA.

# ENERGY STAR® Qualified Modular Homes
# Modular Certifier Application

I, (Name of Certifier) _____ hereby assert that I meet or exceed all required capabilities and qualifications, as contained in the **SBRA Modular Program Guide**, to provide modular plant certification services. In addition, I hereby state that I do not have financial interests in any factory home producer or builder, nor do I provide services that might affect my capacity to evaluate compliance with the ENERGY STAR program and render reports of findings objectively and without bias. Other persons performing services related to ENERGY STAR under my authority also meet these requirements.

Signature of Authorized
Company Representative: _____ Date: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

E-Mail: _____

## Modular housing design, construction and installation methods

*(Must check all boxes below)*

- ❑ Working knowledge of the residential building codes
- ❑ Working knowledge of the plant production processes
- ❑ Working knowledge of modular home design approval and inspection process
- ❑ Knowledge of modular home design, construction, installation, material use and fabrication

## Building science and energy efficiency experience

*(Must check at least one box below and provide copy of HERS certificate, if applicable)*

- ❑ Certified Home Energy Rating System (HERS) Rater or Provider, Accreditation No. _____
- ❑ Licensed Engineer or Architect

*(Must check all boxes below)*

- ❑ Hands-on experience conducting duct and whole-house air infiltration measurements
- ❑ Experience and training in the principles of building science
- ❑ Experience and training in energy efficiency construction practices

## Document preparation and record keeping

*(Must check)*

- ❑ Capability to maintain computer records and communicate via email

## Submit this form to SBRA:

Fax number: 212-496-5389, or
Mailing address: 1776 Broadway, Suite 2205, New York, NY 10019, or
Email: energystar@research-alliance.org

If approved, SBRA will return a countersigned copy of this application to the Certifier. The Certifier shall provide a copy of the approved application to the plant.

**Do not write in this space.**

**SBRA Approval:** _____ **Date:** _____

EPA Form 5900-193
The government estimates the average time needed to fill out this form is 0.17 hours and welcomes suggestions for reducing this effort. Send comments (referencing OMB Control Number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

# ENERGY STAR® Qualified Modular Homes
# Modular Plant Qualification Form

I, (Name of Certifier) _____ hereby certify that

(Manufacturer Name) _____, located at

(Address, City, State) _____ has

demonstrated the ability consistently to produce ENERGY STAR qualified modular homes and is therefore authorized to apply the SBRA ENERGY STAR quality assurance label to new modular homes manufactured under the terms and conditions of the ENERGY STAR program.

Signature: _____ Date: _____

Company: _____

Plant Contact Person: _____ Title: _____

Phone: _____ Fax: _____

E-Mail: _____

## ENERGY STAR design method

*(Must check one below)*

- ❑ ENERGY STAR prescriptive design or BOP
- ❑ Computer analysis to comply under the Performance Path (attached)

## ENERGY STAR features incorporated into factory quality assurance procedures

*(Must check all applicable boxes below)*

- ❑ Information included in third-party-approved design package
- ❑ Information included in plant Quality Control Manual
- ❑ Information included in builder installation instructions

## ENERGY STAR modular home checklist

*(Must check below)*

- ❑ **Inspection Checklist for ENERGY STAR Modular Home** developed identifying items that must be verified in the plant and at the building site

## Homes inspected and tested in the field

*(Must check below)*

- ❑ Three (3) homes meet ENERGY STAR requirements

## ENERGY STAR included into routine factory operations

*(Must check all boxes below)*

- ❑ Corrective actions identified during tests implemented and documented
- ❑ Key plant personnel trained on critical processes and procedures
- ❑ Unique features in ENERGY STAR third-party-approved packages reviewed with plant's third-party design approval agencies
- ❑ Process in place for collecting, tracking and archiving documentation on ENERGY STAR

## Submit this form to SBRA:

Fax number: 212-496-5389, or
Mailing address: 1776 Broadway, Suite 2205, New York, NY 10019, or
Email: energystar@research-alliance.org

EPA Form 5900-194

# ENERGY STAR® Qualified Modular Homes
# Modular Rater Application

I, (Name of Rater) _____ hereby assert that I meet or exceed all required capabilities and qualifications, as contained in the **SBRA Modular Program Guide**, to provide inspection and testing services for ENERGY STAR modular homes. Also, I hereby state that I do not have financial interests in or maintain any affiliation with the construction, sale or completion of a home, nor do I provide services that might affect my capacity to evaluate compliance with the ENERGY STAR program and render reports of findings objectively and without bias. Other persons performing services related to ENERGY STAR under my authority also meet these requirements.

Signature of Rater: _____ Date: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Fax: _____

E-Mail: _____

**Modular housing design, construction and installation methods**

*(Must check all boxes below)*

- ❑ Working knowledge of the residential building codes
- ❑ Knowledge of modular home design, construction, installation, material use and fabrication

**Building science and energy efficiency experience**

*(Must check box below and provide copy of HERS certificate)*

- ❑ Certified Home Energy Rating System (HERS) Rater or Provider, Accreditation No. _____

**Submit this form to SBRA:**

Fax number: 212-496-5389, or
Mailing address: 1776 Broadway, Suite 2205, New York, NY 10019, or
Email: energystar@research-alliance.org

If approved, SBRA will return a countersigned copy of this application to the Rater. The Rater shall provide a copy of the approved application to the builder.

**Do not write in this space.**

**SBRA Approval:** _____ **Date:** _____

EPA Form 5900-191

The government estimates the average time needed to fill out this form is 0.17 hours and welcomes suggestions for reducing this effort. Send comments (referencing OMB Control Number) to the Director, Collection Strategies Division, U.S. EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.