ENERGY STAR Modular Homes Quality Assurance Process

Jordan Dentz
Manufactured Housing Research Alliance

The New Modular Compliance Protocol

- Takes advantage of existing modular QA process
- Same construction requirements as site built home
- Plant certified by third party
- Homes verified by HERS rater

ENERGY STAR Construction

- Prescriptive Builder Option Package (BOP)

or…

- Performance option

Both available with the modular program

ENERGY STAR Modular Home Labels

Quality Assured label applied at the plant

ENERGY STAR label applied in the field

Both labels are required

Third Party Responsibilities

- Certifier
  - Plant certification
  - Periodic inspection
- Rater
  - Inspect all homes
  - Test sample of homes

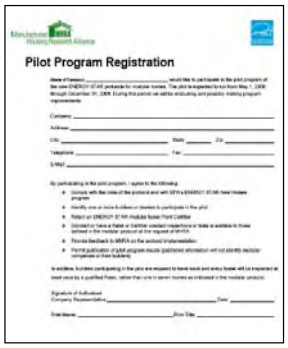
The Plant Process

Steps:

1. Plant registers to participate
2. Plant retains ENERGY STAR Certifier
3. Certifier oversees and verifies certification process
4. Plant orders QA labels
5. Plant builds and ships homes
6. Certifier conducts routine plant inspections

1. Plant Registers for Program

- Opportunity to evaluate program design
- Open to all plants and builders
- Through the end of 2008


Pilot Program Registration

2. Plant Retains Certifier

- Knowledge of modular design, construction and installation
- Building science and energy efficiency experience
- HERS rater, HERS provider, Licensed Engineer or Architect

3. Plant Certification (One Time)

- Led by third-party ENERGY STAR plant certifier
- Educate plant staff
- Develop designs
- Integrate ENERGY STAR into plant QC process
- Build and test three homes

4. ENERGY STAR QA Label

- Ordered by plant from MHRA
- Installed, signed and dated by plant representative

Quality Assured label applied at the plant


This Modular Home Factory Built By:

Quality by Design

Certification

5. Build ENERGY STAR Homes

- Complete ENERGY STAR Modular Checklist for each home
- Ship Checklist with the home


ENERGY STAR Qualified Modular Home Inspection Checklist

6. Periodic Re-inspection of Plant

- Confirm basis for certification
- Test sample homes if necessary
- Review any process or product changes

The Site Completion Process

Steps:

1. Builder retains Rater
2. Builder orders, installs home
3. Rater inspects home including testing sample of homes
4. Rater files completion report, submits to MHRA and receives blue ENERGY STAR label
5. Rater provides ENERGY STAR label to builder of qualifying home

1. Builder Retains Rater

- Third-party HERS rater
- Knowledge of modular construction

2. Install ENERGY STAR Homes

- Builder installs home
- Rater inspects every home at least once
- Rater completes ENERGY STAR Modular Checklist for every home


ENERGY STAR Qualified Modular Home Inspection Checklist

3. Rater Tests Sample of Homes

- Rater tests first two homes from each builder
- Subsequently Rater tests a minimum of 1 in 7 homes from each builder
- Shell leakage and duct leakage as applicable

4. ENERGY STAR Completion Report

- Rater submits Completion report to MHRA for each ENERGY STAR modular home
- MHRA reviews documentation, prints and ships label


ENERGY STAR Modular Home Completion Report

5. ENERGY STAR Completion Label

- Rater provides label to builder for installation in the completed home

ENERGY STAR label applied in the field

Program Documents Attached

- Modular Certifier Application
- Modular Rater Application
- ENERGY STAR Modular Home Inspection Checklist
- ENERGY STAR Qualified Modular Home Completion Report

For More Information

Jordan Dentz
ENERGY STAR Modular Program Coordinator
Manufactured Housing Research Alliance
2109 Broadway, Suite 200
New York, NY 10023
Phone: (212) 496-0900 ext. 13
Fax: (212) 496-5389
Email: jdentz@research-alliance.org

On the Web:
MHRA www.mhrahome.org

Modular Certifier Application

I, (Name of Certifier) _____ hereby assert that I meet or exceed all required capabilities and qualifications to provide ENERGY STAR Certification services as indicated by completing the information on this form. 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 ENERGY STAR services under my authority also meet these requirements.

Authorized company representative: _____ Company: _____

Signature: _____ Date: _____

Address: _____

City/State/Zip: _____

Telephone:_____ Fax:_____ E-Mail: _____

Certifier must complete the following:

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)

- ❑ Certified Home Energy Rating System (HERS) rater or provider
- ❑ Licensed Engineer or Architect

(Must check all boxes below)

- ❑ Hands-on experience conducting duct and whole-house air leakage 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 E-mail

Submit this form to MHRA:

- Fax number: 212-496-5389, or
- Mailing address: 2109 Broadway, Suite 200, New York, NY 10023, or
- E-Mail: info@research-alliance.org

If approved, MHRA 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.

MHRA Approval:_____ **Date:** _____

Modular Rater Application

I, (Name of Rater) _____, hereby assert that I meet or exceed all required capabilities and qualifications to provide ENERGY STAR Rater services as indicated by completing the information on this form. In addition, I hereby state that I do not have financial interests in or maintain any affiliation with 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 ENERGY STAR services under my authority also meet these requirements.

Authorized company representative: _____ Company: _____

Signature: _____ Date: _____

Address: _____

City/State/Zip: _____

Telephone:_____ Fax:_____ E-Mail: _____

Rater must complete the following:

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 at least one box below)

- ❑ Certified Home Energy Rating System (HERS) rater

Submit this form to MHRA:

- Fax number: 212-496-5389, or
- Mailing address: 2109 Broadway, Suite 200, New York, NY 10023, or
- E-Mail: info@research-alliance.org

If approved, MHRA 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.

MHRA Approval:_____ **Date:** _____

ENERGY STAR Qualified Modular Home Inspection Checklist

Home Address: _____ City: _____ State: _____

Instructions: Write your initials in each applicable box. If the item does not apply to the home, write in "n/a". Raters should attempt to inspect as many critical items as possible but may delegate a builder's representative to verify and initial select items.

Thermal Bypass Item	Inspection Guidelines	PLANT QC	RATER	
		Pass	Pass	Fail
Overall Air Barrier and Thermal Barrier Alignment	**General requirements:** ▪ 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:** ▪ Fully insulated wall aligned with air barrier at both interior and exterior, **OR** ▪ Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported ▪ 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:** ▪ Air barrier is installed at any exposed insulation edges ▪ Insulation is installed to maintain permanent contact w/ sub-floor above			
	3.1 Insulated floor above garage	_____	_____	_____
	3.2 Cantilevered floor	_____	_____	_____
Shafts	**General requirements:** ▪ 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:** ▪ 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 ▪ 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:** ▪ 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	_____	_____	_____

BOP Item[1]	Inspection Guidelines	PLANT QC	RATER	
		Pass	Pass	Fail
Cooling Equipment *(when provided)*	**General requirements:** **Hot Climates** (2006 IRC Climate Zones 1,2,3) Right-Sized**:** ▪ ENERGY STAR qualified A/C (*14 SEER / 11.5 EER*); **OR** ENERGY STAR qualified heat pump (*14 SEER / 11.5 EER / 8.2 HSPF*). **Mixed and cold climates** (2006 IRC Climate Zones 4,5,6,7,8) Right-sized**:** ▪ 13 SEER A/C; OR ENERGY STAR qualified heat pump (*14 SEER /11.5 EER / 8.5 HSPF*).	_____	_____	_____
Heating Equipment	**General requirements:** **Hot Climates** (2006 IRC Climate Zones 1,2,3)**:** ▪ 80 AFUE gas furnace; **OR** ENERGY STAR qualified heat pump *(14 SEER / 11.5 EER / 8.2 HSPF)*; **OR** 80 AFUE boiler; **OR** 80 AFUE oil furnace. **Mixed and Cold Climates** (2006 IRC Climate Zones 4,5,6,7,8)**:** ▪ ENERGY STAR qualified gas furnace (90 AFUE); **OR** ENERGY STAR qualified heat pump; **OR** ENERGY STAR qualified boiler (85 AFUE); **OR** ENERGY STAR qualified oil furnace (85 AFUE).	_____	_____	_____
Thermostat	**General requirements:** ▪ ENERGY STAR qualified thermostat (except zones with radiant heat)	_____	_____	_____
Ductwork	**General requirements:**			
	▪ Leakage: < 4 cfm to outdoors / 100 sq. ft.	_____	_____	_____
	▪ R-6 min. insulation on ducts in unconditioned spaces	_____	_____	_____
	▪ All exterior ducts have been installed and wrapped with insulation	_____	_____	_____
	▪ Crossover collar secured to the trunk with three or more screws and cannot move	_____	_____	_____
	▪ Nylon or metal straps and saddles are used to support the exterior duct; duct does not touch ground	_____	_____	_____
	▪ Three or more screws are placed below the straps through the flexible duct and into the crossover collar	_____	_____	_____
	▪ Exterior duct installation is pushed into the floor cavity and sealed with tape or foam sealant at all bottom board penetrations.	_____	_____	_____
Envelope	**General requirements:**			
	▪ Infiltration (ACH50): 7 in CZ's 1-2 | 6 in CZ's 3-4 | 5 in CZ's 5-7 | 4 in CZ 8	_____	_____	_____
	▪ Insulation levels that meet or exceed the 2006 IRC	_____	_____	_____
Windows	**General requirements:** ▪ ENERGY STAR qualified windows or better (additional requirements in CZ2 and CZ4)	_____	_____	_____
Water Heater	**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: Integrated with space heating boiler	_____	_____	_____
Lighting and Appliances	**General requirements:** ▪ Five or more ENERGY STAR qualified appliances, light fixtures, ceiling fans equipped with lighting fixtures, and/or ventilation fans	_____	_____	_____
Marriage Line Seal	**General requirements:** ▪ 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.	_____	_____	_____
Bottom Board	**General requirements:** ▪ All tears in the bottom board covered and sealed with a durable, permanent patch to prevent air leakage. (Foam sealant can be used on lag bolt and other small holes.)	_____	_____	_____
Performance Path Option[2]	All performance path specifications have been adhered to.	_____	_____	_____

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

[1] If a performance path is used, write in **n/a** for BOP items and complete the Performance Path section.
[2] If a BOP is used, write in **n/a** for the Performance Path section and complete the applicable BOP items.

ENERGY STAR Modular Home Completion Report

1. CONTACT INFORMATION

a) Rater primary contact

Company | Name

Address

City | State | Zip

Telephone | Email

b) Rater field tester (if different from primary contact)

Company | Name

Address

City | State | Zip

Telephone | Email

c) Factory

Corporate Parent

Plant name

Plant City | Plant State | Zip

d) Builder

Company | Name

Address

City | State | Zip

Telephone | Fax

e) Homeowner

Name

Telephone

f) Home location

Address

City | State | Zip

If the home was inspected/tested as per the ENERGY STAR Modular Homes protocol, complete the following:

2. QUALITY ASSURED LABEL (must check one to pass)

a) An MHRA ENERGY STAR Modular Home Quality Assured Label is affixed to the home interior and signed and dated by a factory representative ..... ☒

b) This home is one of the factory's initial three certification homes (QA label to be provided – see below)..... ☒

3. HOUSE TIGHTNESS (must be checked to pass)

a) ACH50. Measured: _____(must be **7.0 or less**) ..... ☒

4. DUCT TIGHTNESS (ONE must be checked to pass)

a) Duct leakage to outside at **25 pascals**. Measured: _____ (must be **≤ 4 cfm to outdoors / 100 sq. ft. or less**) .... ☒

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..... ☒

5. RATER EVALUATION (check one)

a) PASSES: No discrepancies were identified ..... ☒

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

Signature of Rater: _____ **Date:** _____

Complete all applicable items and send with a completed copy of the ENERGY STAR Modular Home Checklist and, if home passes, a check for $40 ($140 per home for the initial three factory certification homes) to: **Manufactured Housing Research Alliance**, 2109 Broadway, Suite 200, New York, NY 10023**.**

DESCRIPTION OF PROBLEMS/DISCREPANCIES AND REMEDIATION ACTIONS

Item number: _____	Discrepancy	
	Remediation	

Item number: _____	Discrepancy	
	Remediation	

Item number: _____	Discrepancy	
	Remediation	

Item number: _____	Discrepancy	
	Remediation	