

ENERGY STAR for Manufactured Homes

Quality Assurance Perspective



Program overview

- ~120 plants nationwide qualified to produce ENERGY STAR manufactured homes
- About 30 plants (excluding the NW) are actively producing ENERGY STAR-qualified homes

Three components to the program

- Plant certification – one time process
- Production and in-plant inspection of homes
- Field inspection and tests

Certification Step 1: Retain a Certifier

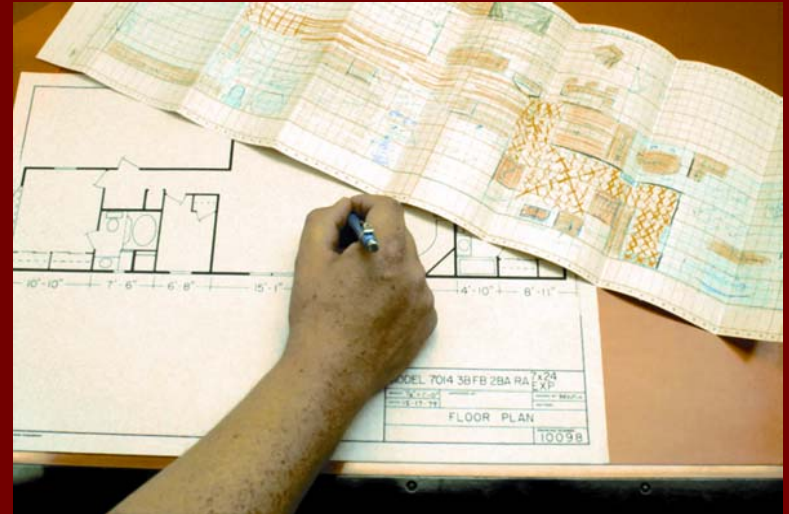
- Retain an ENERGY STAR manufactured home plant certifier
- Independent, third-party with expertise in factory building techniques and energy efficiency



In-plant inspection

Certification Step 2: Design Homes

- Design homes to meet ENERGY STAR requirements
- Prescriptive packages or computer analysis

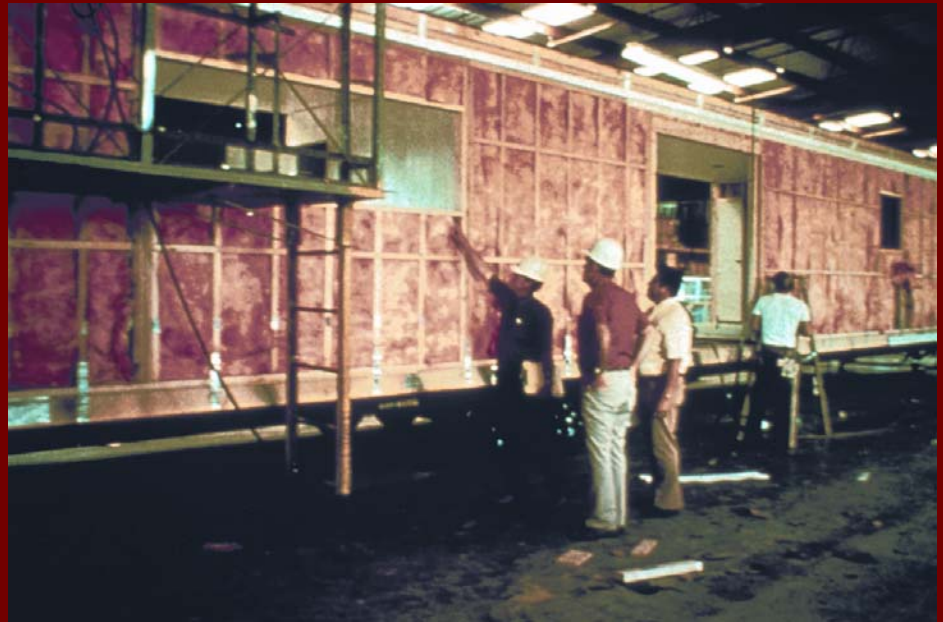


Plan review

Certification Step 3:

Incorporate design into QC process

- ENERGY STAR features incorporated into:
 - Design Approval Primary Inspection Agency (DAPIA)-approved packages
 - Plant Quality Control Manual
 - Manufacturer's Installation Manual



Certification Step 4: Test Homes in the Plant

- Manufacture and verify the performance of three consecutive homes
- Test ducts
- Certifier verifies that the ducts do not exceed allowable leakage levels



In-plant inspection

Certification Step 5: Develop Site Installation Checklist

- The **Site Installation Checklist** identifies items that are part of the ENERGY STAR design package verified at the time of home installation
- Certifier approves checklist

SAMPLE ENERGY STAR QUALIFIED MANUFACTURED HOME SITE INSTALLATION CHECKLIST				APPENDIX D
<small>Note: This form can be automatically custom-generated for each home by the MHRA ENERGY STAR Information Manager</small>				
HOME MANUFACTURER				
Company		Contact	Home serial number	
Address		City	State	Telephone
<small>Instructions for manufacturer's field representative:</small>				
<small>1. Fill in retailer and homeowner contact information.</small>				
<small>2. Verify that all ENERGY STAR CONSTRUCTION REQUIREMENTS listed below have been successfully completed.</small>				
<small>3. Confirm that the EPA ENERGY STAR and MHRA Quality Assured labels are affixed to the home.</small>				
<small>4. When all ENERGY STAR construction requirements have been successfully completed:</small>				
<small>• Sign and date this form.</small>				
<small>• Sign and date the MHRA Quality Assured™ label (near the HUD data plate or the main electrical panel).</small>				
<small>• Promptly return this completed form to the manufacturer.</small>				
<small>If there are any discrepancies, contact the manufacturer immediately.</small>				
RETAILER*				
Company		Contact	Telephone	
Address		City	State	
HOMEOWNER*				
Name		Telephone		
Address		City	State	County
ENERGY STAR CONSTRUCTION REQUIREMENTS				
A. Marriage Line Seal				
<small>The marriage line areas must be filled with a continuous non-porous insulating gasket creating a permanent air barrier at joints in the ceiling, walls and floor. Acceptable gaskets can be one or two-part systems, including proprietary gaskets, foams, insulation wrapped in poly, and insulation covered by butyl or other long-life tape on one side. In addition, there must be no visible signs of gaps or tears.</small>				
B. Tears in Bottom Board Material Repaired				
<small>All tears in the bottom board material must be covered and sealed with a durable, permanent patch to prevent air leakage. (Foam sealant can be used on lag bolt and other small holes.)</small>				
C. Exterior (Including Crossover) Duct Installation				
<small>For multi-section homes, the exterior ducts must be sealed with a permanent connection per the Manufacturer's Installation Manual. Identify that the following items are completed:</small>				
<input type="checkbox"/> All exterior ducts have been installed and wrapped with insulation.				
<input type="checkbox"/> Crossover collar is secured to the trunk with at least three screws and cannot rotate or move.				
<input type="checkbox"/> All exterior duct insulation is a minimum of R-_____.				
<input type="checkbox"/> Nylon or metal straps and saddles are used to support the exterior duct; duct does not touch the ground.				
<input type="checkbox"/> Three or more screws are placed below the straps through the flexible duct and into the crossover collar.				
<input type="checkbox"/> Exterior duct insulation is pushed into the floor cavity and sealed with tape or foam sealant at all bottom board penetrations.				
D. Field Installed Heat Pump				
<input type="checkbox"/> Heating equipment efficiency meets or exceeds the following specification: HSPF-_____.				
E. For Homes Installed Over Basements (One of the following must be checked)				
<input type="checkbox"/> This home has an UNHEATED BASEMENT. All interior stairwells from the heated space into the basement are constructed in the same manner as an exterior wall with full insulation and a weather-stripped, insulated exterior door.				
<input type="checkbox"/> This home has a HEATED BASEMENT. The basement wall insulation level is a minimum of R-_____.				
Signature (Manufacturer's Representative)		Print Name	Date	
Fax this completed form to _____ or mail to the home manufacturer at the address above.				
		Fax Number		
<small>A copy of the Sample ENERGY STAR Manufactured Home Site Installation Checklist is available on the web at: http://www.mhrahomes.org. This is a model checklist. Manufacturers may have their own.</small>				
<small>*The retailer and/or homeowner may be contacted as part of the ENERGY STAR for Homes quality assurance program.</small>				

Certification Step 6: Field Tests

- Install three ENERGY STAR qualified homes in the field
- Test for shell and duct leakage
- Certifier verifies that maximum allowable levels are not exceeded



Certification Step 7: Incorporate into Routine Operations

- Transfer lessons learned from the certification process into routine production of ENERGY STAR qualified homes



Ceiling drywall is foamed to
roof trusses

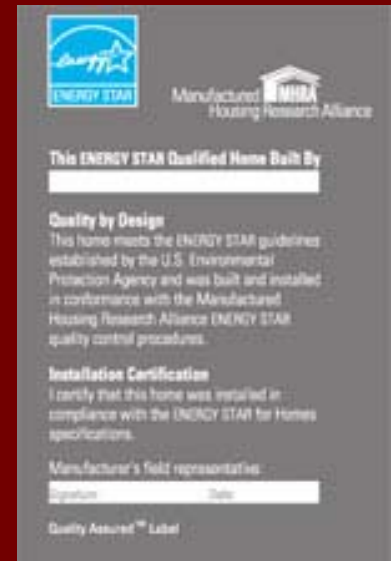
Certification Step 8: Submit Documentation

- Certifier submits to MHRA the plant certification form
- Plant submits to EPA the ENERGY STAR partnership agreement

Producing ENERGY STAR Qualified Homes

Producing Step 1: Manufacture and Inspect Homes

- Manufacture homes in accordance with the approved designs
- Every home is inspected on the production line
- Homes display the ENERGY STAR label and Quality Assured label



EPA and MHRA labels

Producing Step 2:

Install and Inspect Homes in the Field

- Plant representative uses **Site Installation Checklist** to monitor set-up
- Non-compliance items fixed on site
- **Site Installation Checklist** completed, signed by the plant representative and returned to the plant

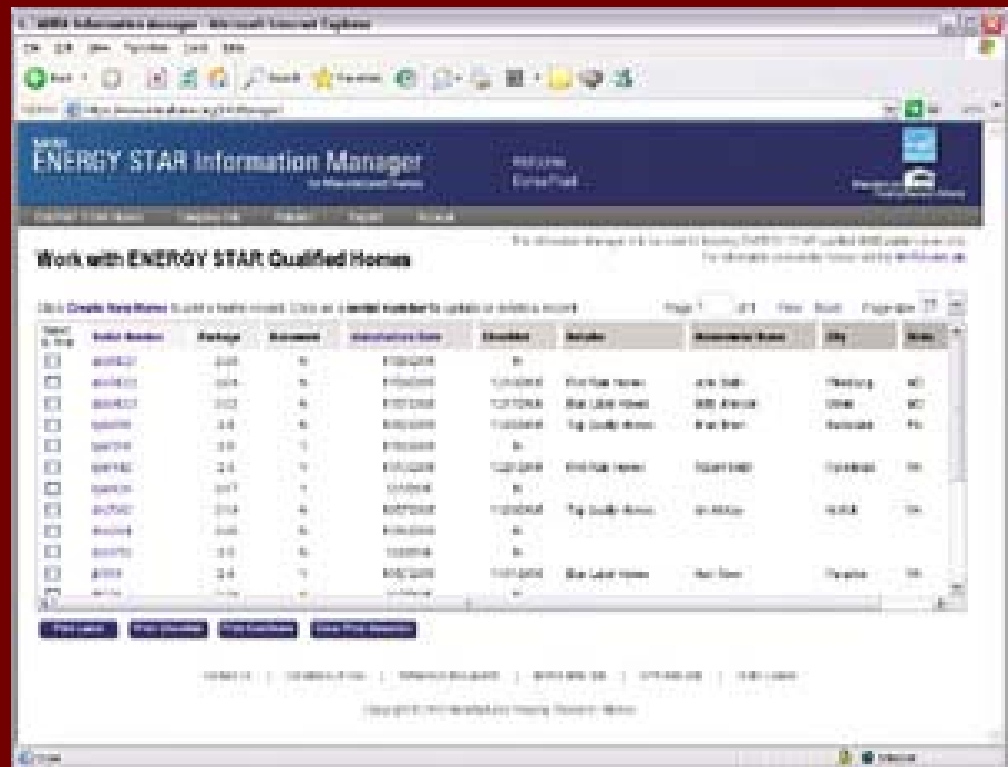


Home installation

Maintaining Plant Certification

Maintaining Step 1: Use the MHRA Information Manager

- Web-based system used by plants to keep track of and report production of ENERGY STAR qualified homes



MHRA ENERGY STAR
Information Manager

Maintaining Step 2:

Conduct Field Evaluations

- Plant must at all times retain an accredited ENERGY STAR Certifier
- Certifier conducts field evaluations on 2 percent of each plant's ENERGY STAR qualified homes

Field Evaluation: Inspection

Verify the following

- Documentation, including DAPIA package
- Labels
- Equipment efficiency
- Set-up requirements (crossover duct, bottom board)
- Basement insulation

Field Evaluations: Testing

Field duct blaster test

- Duct leakage
- Shell leakage

Field blower door test



Quality enhancers

- The manufacturing environment
 - Leveraging the in place quality control process
 - Production methods made possible by building in a plant (e.g., large dry wall sheets foamed to roof framing for air-tight seal)
 - Investment by plant in proven techniques (duct blaster testing in plant)

Quality enhancers

- Features of manufactured homes
 - Simple construction detailing and design
 - Universal application of prescriptive features (factory-installed marriage joint gasket)
 - simple wall/roof thermal envelope without many corners and complicated shapes
 - fully installed homes without complicated dormers, garage/home interfaces

Rapid Dissemination of Energy Innovations

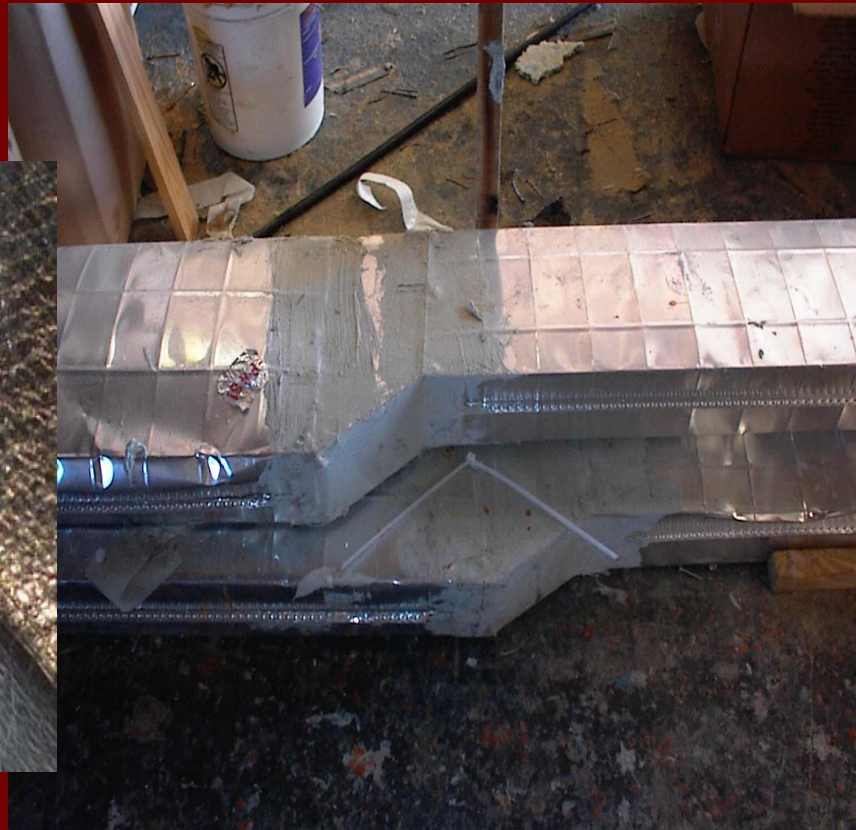


In-plant duct test



Factory-installed marriage line gasket for through-the-rim crossover

Rapid Dissemination of Energy Innovations



Wide use of mastic for duct sealing

Quality enhancers

- Continuous improvement
 - Less than 20 Certifiers nationwide, some working in association with local HERs raters (some are also HERs raters)
 - Requirement of all Certifiers to attend three meetings per year
 - Real time monitoring of every ENERGY STAR manufactured home build assuring timely and effective QC oversight

Culture of Continuous Improvement



Training plant personnel on the proper application of mastic



Duct tightness testing in the plant

More information

Further information:

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Alliance
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New York, NY 10025

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Web: www.mhrahome.org

