

Building
Energy Star Homes
with the
Urban Redevelopment
Authority of Pittsburgh



BUILDING PITTSBURGH WITH

URA

URBAN REDEVELOPMENT
AUTHORITY OF PITTSBURGH



The Urban Redevelopment Authority of Pittsburgh now requires Energy Star certification for all new residential construction projects that we build or finance. Energy Star requirements make homes more energy efficient and comfortable which helps homeowners save money on utility bills and prevents unwanted pollution from energy production (mercury, particulates, CO₂, etc.) from entering our atmosphere.

In addition to Energy Star standards the URA has adopted the Environmental Protection Agency's Indoor Air PLUS specifications which address other aspects of "whole house" performance. These additional specifications help make Energy Star homes more durable and healthy to live in by addressing issues including moisture and indoor air quality.

The following guidelines highlight some of the often overlooked aspects of these two programs to help ensure that the development team incorporates these items into their drawings and specifications prior to putting projects out to bid. For a complete overview of the URA Energy Star Residential Development Process including submittals, inspections and testing, and approvals please refer to the URA Energy Star Process for New Residential Development on page 9 of this handbook.

NOTE: While the URA requires Energy Star certification for all new residential construction projects, we currently only require that specifications (and not inspection and verification requirements) from the EPA Indoor Air PLUS program be incorporated into drawings and specifications. Items 6.1, 6.2, and 6.3 from the Indoor Air PLUS Verification Checklist must be shown as alternates in bid proposals, while items 2.2, 5.6, and 7.3 are not currently required.

HVAC SYSTEMS

Manual J Load Calculations (*EPA Indoor Air PLUS Item 4.1*)

- Manual J load calculations must be done for each unit type to determine the proper sizing of heating and cooling equipment.
- Prior to final construction documents the project architect must submit a Manual J load calculation summary report showing the inputs, calculated loads, and recommended equipment sizing.
- Calculations should use "Tight" under Construction Quality in the Infiltration Section using the Simplified Calculation Method.

Ductwork (*EPA Indoor Air PLUS Item 4.2-4.3*)

- Duct Systems must be sized according to ACCA Manual D, ASHRAE Handbooks, or equivalent software and be substantially airtight, properly balanced, and protected from construction debris.
- All supply and return paths must be fully ducted and cannot use panned returns or building cavities.
- All seams and joints in ductwork must be sealed with UL-181 approved duct sealing mastic or UL-181 approved foil tape.
- No ductwork or mechanical equipment should be located in garage spaces.
- Every effort should be made to keep ductwork out of ceiling and wall framing adjacent to attached garages.
- In no instance should return ductwork be located in attached garage ceilings or walls.

Continuous Ventilation (*EPA Indoor Air PLUS Item 4.5*)

Energy Star homes are more airtight than conventional homes and require mechanical ventilation to ensure that the minimum required amount of fresh air is being supplied to the building occupants. There is some question regarding the reasoning for going through the effort to make a building tighter and then using mechanical ventilation to bring in fresh air, instead of building a less airtight structure to begin with. It is very difficult to provide the right amount of ventilation through haphazard holes in the building envelope, providing either too much or too little air. Building an airtight envelope and then providing controlled ventilation allows for just the right amount of ventilation based on the actual measured airtightness of the building envelope.

In order to achieve the right amount of mechanical ventilation the URA requires a bath fan rated for continuous operation to be installed in one upstairs bathroom. The fan must be Energy Star qualified and should be equipped with a motion sensor, variable speed control, and a delay which returns the fan to the lower background ventilation within a pre-defined period of time after the motion sensor is activated.

Your HERS rater will tell you what size fan to specify based on their plan review and REM/Rate energy model. The variable speed fan will be adjustable through a range of CFM settings. The final background ventilation rate will be set once the HERS rater's performance testing has revealed what the actual airtightness

of the building envelope is. This rate is based upon the ASHRAE 62.2 ventilation requirement of 7.5 CFM per person + 1CFM per 100 square feet of floor area.

The following fans currently meet the URA’s requirements for continuous ventilation equipment (*Please note, the URA does not endorse any particular manufacturer. The following are simply products that have been found to meet our requirements. There may be other products available and the URA encourages you to research products before specifying.*):

Panasonic WhisperGreen Ventilation Fans
<http://www.panasonic.com/business/building-products/ventilation-systems/products/whisper-green.asp>

Local Exhaust Ventilation (EPA Indoor Air PLUS Item 4.6)

All kitchen hoods, bath fans, and clothes dryers **must** be ducted to the outdoors. **Suggested** ventilation rates for each of these areas are listed below:

Bathrooms

Bathroom size	Calculation formula	Ventilation rate required
Less than 100 square feet	1 CFM per square foot of floor area	A minimum of 50 CFM*
More than 100 square feet	Add the CFM requirement for each fixture	Toilet 50 CFM Shower 50 CFM Bathtub 50 CFM Jetted tub 100 CFM

Source: Home Ventilating Institute <http://www.hvi.org/resourcelibrary/HowMuchVent.html>

*Bathrooms with a continuous ventilation fan set to run at a minimum continuous ventilation rate of 20 CFM do not need to meet the above requirements.

Kitchens

Location of range	HVI-recommended ventilation rate per linear foot of range	Minimum ventilation rate per linear foot of range
Against a wall	100 CFM	40 CFM
In an island	150 CFM	50 CFM

Width of hood against a wall	2.5 feet (30 inches)	3 feet (36 inches)	4 feet (48 inches)
HVI-recommended rate	250 CFM	300 CFM	400 CFM
Minimum	100 CFM	120 CFM	160 CFM

Source: Home Ventilating Institute <http://www.hvi.org/resourcelibrary/HowMuchVent.html>

- For hoods located over islands multiply the rate by 1.5.
- For professional-style cook tops, HVI recommends following the cook top manufacturer's advice to determine ventilation requirements.
- Inflated performance ratings are common for range hoods that are not HVI-Certified. Selecting range hoods with HVI-Certified Performance Ratings will ensure that ventilation expectations and building code requirements are met.

Dryers

The maximum length of duct permitted by code for a dryer is 25 ft. This maximum length should be reduced by 2.5 ft for each 45-degree bend and 5 ft. for each 90-degree bend.

Ventilation General

- For all local ventilation ductwork the shortest possible length of ductwork should be used.
- All ductwork must be a minimum nominal size of 4 inches (4") in diameter.
- Rigid sheet metal is **required** for all local ventilation ductwork to reduce resistance to airflow and to prevent restriction of airflow due to kinks, excessive bends, and sagging of ductwork (common with flexible ductwork).
- Seams in local ventilation ductwork must be sealed with UL-181 approved duct sealing mastic or UL-181 approved foil tape.
- All ductwork in unconditioned space must be insulated with a minimum of R-8 Insulation covered with a vapor barrier to prevent condensation from occurring on the inside or outside of the ductwork.

Radon (EPA Indoor Air PLUS Item 2.1)

All residential units must be equipped with radon control systems per local code (IRC 2006, Appendix F). These systems must include:

- perforated underslab piping

- a continuous and sealed underslab vapor barrier (6-mil polyethylene or equivalent)
- internal piping venting through the roof of the unit
- installation of a junction box immediately adjacent to the piping through the attic in case testing reveals that mechanical ventilation must be added to the passive system
- All units must provide attic access through an access hatch or other means.

MOISTURE CONTROL (*EPA Indoor Air PLUS Items 1.1-1.13*)

Energy Star homes are more airtight than conventionally built homes, and therefore are less forgiving of issues relating to moisture. It is especially important to ensure proper drainage of bulk water away from the home. This means proper layering of the drainage plane and proper flashing around all windows, doors, and roof intersections. It also means proper grading away from homes and proper roof and gutter details.

INDOOR AIR QUALITY

The airtightness of Energy Star homes, which reduces energy consumption for heating and cooling, also makes the issue of Indoor Air Quality (IAQ) more of a priority. In addition to proper ventilation and radon control (see HVAC section of this guidebook) the following areas should receive special attention in Energy Star homes:

Attached Garages (*EPA Indoor Air PLUS Item 5.5*)

Attached garages must be completely isolated from the occupied areas of the home. There must be a complete air barrier between the ceiling and walls of attached garages and adjacent spaces. There must not be any pathways for air to travel from the attached garages into the occupied areas of the home. The following are ways in which this can be achieved:

- Closed cell urethane foam insulation installed up to the required R-value for the assembly (e.g. exterior walls, floors over unconditioned spaces).
- A “flash spray” of closed cell urethane foam to achieve an air barrier and any combination of cellulose, fiberglass, or rigid insulation up to the required R-value for the assembly.

- Sealing any penetrations in framing members and floor sheathing material prior to drywall. After drywall is installed seal all gaps around outlets and any other penetrations through drywall.
- Install blocking (wood or rigid foam) in joist bays above common garage/house walls and seal with closed cell urethane foam.
- Doors between the occupied areas of the home and attached garages must be rated for exterior use, insulated, and equipped with weatherstripping and self closing hinges.
- If supply ductwork is located in common garage/house ceiling and wall framing a continuous bead of caulk or adhesive should be used on the joists/studs adjacent to the ductwork.

Materials (*EPA Indoor Air PLUS Item 6.1-6.3*)

Materials installed in Energy Star homes should be low-emitting in terms of their ability to “offgas” harmful chemicals like VOC’s and formaldehyde. The EPA Indoor Air PLUS specifications address this in items 6.1, 6.2, and 6.3. The URA requires developers to request alternate bids for these items in bid documents.

Building Energy Star with the URA Resources

Energy Star

Energy Star Home Page

<http://www.energystar.gov/index.cfm?c=home.index>

Thermal Bypass Checklist

[http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Thermal Bypass Inspection Checklist.pdf](http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Thermal_Bypass_Inspection_Checklist.pdf)

Thermal Bypass Checklist Guide

http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/TBC_Guide_062507.pdf

EPA Indoor Air PLUS

EPA Indoor Air PLUS Home Page

<http://www.epa.gov/indoorairplus/index.html>

EPA Indoor Air PLUS Construction Specifications

http://www.epa.gov/indoorairplus/construction_specifications.html

HERS Raters

Local Certified HERS Raters (For third party inspections and final testing)

http://www.resnet.us/directory/raters_builders.aspx

What is the HERS Index?

http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_HERS

Other

Federal Tax Credits for Energy Efficiency (\$2000/house to builder/developer)

http://www.energystar.gov/index.cfm?c=products.pr_tax_credits

URA Energy Star Process for New Residential Development

1. **Prior to Design Review Committee Meeting**, Architect/Developer provides Conceptual Designs for each unit type to Development Officer who forwards to URA Sustainability Coordinator for review and comment (digital copies preferred)
2. **At Design Review Committee Meeting**, Sustainability Coordinator provides Development Team (Developer and Architect) with URA Energy Star Guidelines and answers any questions development team may have regarding Energy Star requirements.
3. Architect or Developer submits **UNSIGNED HERS Rater Pricing Proposal and Scope** to Development Officer who forwards to URA Sustainability Coordinator (copy Construction Division Manager) for review and approval of cost and scope.
4. Development Officer organizes Design Development Meeting with architect, Developer, HERS Rater, and Sustainability Coordinator to discuss project goals and to select alternative assemblies to be modeled.

The Processes below can occur simultaneously

<ol style="list-style-type: none"> 5. Architect provides <u>Preliminary Plan Set and Specifications</u> for each unit type to HERS Rater for review and energy modeling. 6. HERS Rater submits <u>Plan Review Comments, Projected Ratings for modeled alternatives and Modeling and Plan Review Invoice</u> to architect/developer who sends copies to Development Officer. Development Officer forwards these documents to URA Sustainability Coordinator for review and approval. 	<ol style="list-style-type: none"> 7. Architect provides <u>Preliminary Plan Set and Specifications</u> for each unit type to Development Officer who forwards to URA Sustainability Coordinator for review and comment (digital copies preferred) 8. Sustainability Coordinator reviews <u>Preliminary Plan Set and Specifications</u> and sends Redlined <u>Preliminary Plan Set and Specifications</u> to Development Officer who forwards them to the Development Team.
---	--

9. **PRIOR TO CONTRACTOR BIDDING**, Architect creates Revised Drawings and Specifications based on redlined drawings and comments from Sustainability Coordinator, URA Architect and HERS Rater. Contractor Bid Proposals should include pricing for alternate assemblies and equipment modeled in energy model

10. **PRIOR TO FINAL CONSTRUCTION DOCUMENTS**, Architect submits Revised Drawings and Specifications, including Manual J load calculations showing proper sizing of HVAC systems and Manual D duct sizing worksheet or annotated layout for each unit type to Development Officer who forwards them to Sustainability Coordinator for review and comment (digital copies preferred). Revised submissions will follow the same path for review until the final documents have been accepted by the Sustainability Coordinator. When the final drawings and specifications have been approved, the Sustainability Coordinator will send an approval memo to the Development Officer.

11. Architect notifies HERS Rater and Development Officer about time and date of Construction Kickoff Meeting. Development Officer notifies Construction Advisor and Sustainability Coordinator about time and date of meeting. At Construction Kickoff Meeting, Sustainability Coordinator discusses URA policy requiring Energy Star certification and gives an overview of Energy Star requirements and rationale. Sustainability Coordinator provides at least one copy of URA Energy Star Guidelines and Thermal Bypass Checklist Guide to Development Team. HERS Rater describes their inspection and testing process and requirements. Development Team presents Preliminary Construction Schedule.

12. **PRIOR TO INSULATION**, Site Supervisor notifies HERS Rater, Architect, and Construction Advisor that they are ready for Pre-Insulation Thermal Bypass Inspection (1 week minimum advance notice if possible). Construction Advisor notifies Development Officer and Sustainability Coordinator about date and time of Pre-insulation Thermal Bypass Inspection. After Pre-Insulation Thermal Bypass Inspection, HERS Rater will provide written summary of any items that either did not meet the inspection criteria or could not be confirmed at the time of the inspection to the Site Supervisor, Architect, and Construction Advisor. Construction Advisor will provide copy to Development Officer and Sustainability Coordinator. **Any items that need to be confirmed by HERS Rater must be completed prior to drywall installation. A maximum of 6**

items can be confirmed by Site Supervisor. Site supervisor must photograph any self verified items and submit copies of photographs (digital preferred) to HERS Rater and Construction Advisor. Construction advisor will send copies of photos to Loan Officer and Sustainability Coordinator.

13. **PRIOR TO DRYWALL**, Site Supervisor notifies HERS Rater, Architect, and Construction Advisor that they are ready for Pre-Drywall Thermal Bypass Inspection (1 week min advance notice if possible). Construction Advisor notifies Development Officer and Sustainability Coordinator about date and time of Pre-Drywall Thermal Bypass Inspection. After Pre-Drywall Thermal Bypass Inspection, HERS Rater will provide written summary of any items that either did not meet the inspection criteria or could not be confirmed at the time of the inspection to the Site Supervisor, Architect, and Construction Advisor. Construction Advisor will provide a copy to Development Officer and Sustainability Coordinator. **HERS Rater and/or Site Supervisor must confirm that outstanding items from Thermal Bypass Checklist have been completed prior to installation of drywall. A maximum of 6 items can be confirmed by Site Supervisor Site supervisor must photograph any self verified items and submit copies of photographs (digital preferred) to HERS Rater and Construction Advisor.** HERS Rater submits written document (can be signed copy of completed Thermal Bypass Checklist) confirming successful completion of Thermal Bypass Inspection to Site Supervisor, Architect, and Construction Advisor. Construction Advisor provides copies to Development Officer and Sustainability Coordinator (digital copies preferred). HERS Rater submits Inspection Invoice to Architect once inspections for all units have been completed. Architect submits copy of Inspection Invoice to Development Officer who forwards to Sustainability Coordinator for approval.

Note: The above 2 inspections can be combined at the discretion of the HERS rater. At a minimum at least one unit (the first) must be inspected with 2 separate inspections.

14. **POST CONSTRUCTION**, HERS Rater coordinates with Site Supervisor to schedule Performance Testing (Site Supervisor should confirm what needs to be completed e.g. registers, thermostats, electrical cover plates, attic access weatherstripping, etc.). HERS Rater notifies Architect and Construction Advisor when Performance Testing is to occur (1 week minimum advance notice if possible). Construction Advisor notifies

- Development Officer and Sustainability Coordinator about date and time of Performance Testing.
15. HERS Rater conducts Performance Testing and notifies Site Supervisor, Architect, and Construction Advisor of results of testing. Construction Advisor notifies Development Officer and Sustainability Coordinator of results.
 - a. If Performance Testing reveals that the home **will not** meet Energy Star standards, HERS Rater must immediately notify Site Supervisor, Architect, and Construction Advisor **IN WRITING** about suspected reasons for failure and potential ways in which the failure can be remedied. Construction Advisor forwards this information to Development Officer and Sustainability Coordinator.
 - b. If Performance Testing reveals that the home **will** meet Energy Star standards, HERS Rater submits **AS BUILT REMRate Files/Reports and Draft Confirmed Ratings** to Architect, Developer, and Development Officer who forwards this information to Sustainability Coordinator.
 16. HERS Rater submits Energy Star Documentation to HERS Provider to receive Energy Star certification labels and certificates. Upon receipt of Energy Star labels and certificates HERS Rater provides Original Copies of Energy Star Certificates to Developer and Copies of Energy Star Certificates to Builder, Architect, and Development Officer. Development Officer sends copy of certificates to Sustainability Coordinator. HERS Rater submits Final Testing and Certification Invoice to Architect with certification documentation for all units. Architect submits copy of Final Testing and Certification Invoice to Development Officer who forwards to Sustainability Coordinator for review and approval.
 17. Development Officer makes arrangements with Developer, Architect, and HERS Rater to label homes.

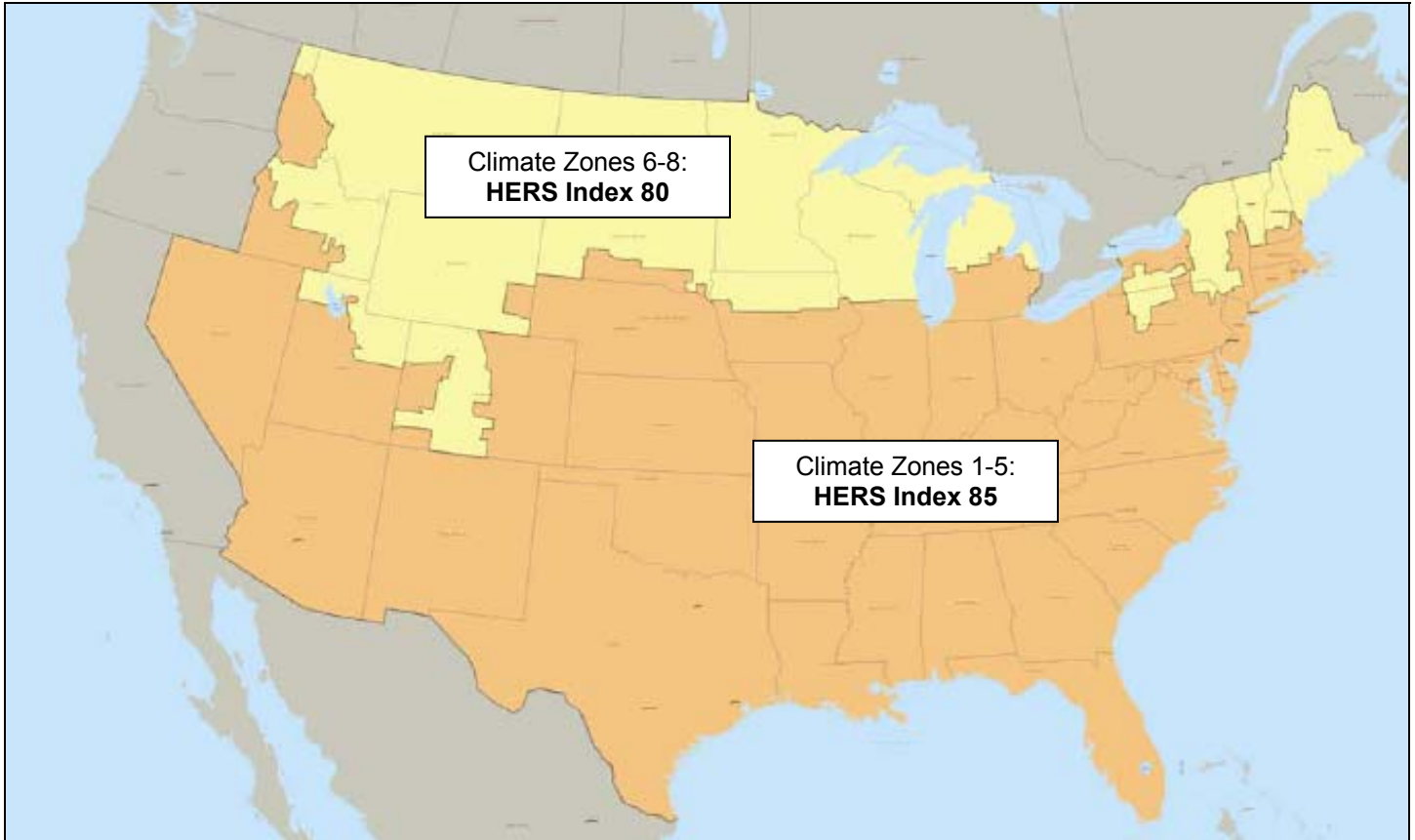


ENERGY STAR Qualified Homes National Performance Path Requirements

ENERGY STAR Performance Requirements:

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

Maximum HERS Index Required to Earn the ENERGY STAR¹



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

ENERGY STAR Mandatory Requirements:

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



ENERGY STAR Qualified Homes National Performance Path Notes

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

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

In specifying equipment, the next available size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI standards.

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



ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist

The Thermal Bypass Inspection Checklist must be completed for homes to earn the ENERGY STAR label. The Checklist requires visual inspection of framing areas where air barriers are commonly missed and inspection of insulation to ensure proper alignment with air barriers, thus serving as an extra check that the air and thermal barriers are continuous and complete. State, local, and regional codes, as well as regional ENERGY STAR program requirements, supersede the items specified in this Checklist.

Guidance on Completing the Thermal Bypass Inspection Checklist:

1. Accredited HERS Providers and certified home energy raters shall use their experience and discretion in verifying that each Inspection Checklist item is installed per the inspection guidelines (e.g., identifying minor defects that the Provider or rater deems acceptable versus identifying major defects that undermine the intent of the Checklist item).
2. Alternative methods of meeting the Checklist requirements may be used in completing the Checklist, if the Provider deems them to be equivalent, or more stringent, than the Inspection Checklist guidelines.
3. In the event an item on the Checklist cannot be verified by the rater, the home cannot be qualified as ENERGY STAR, unless the builder assumes responsibility for verifying that the item has met the requirements of the Checklist. This option is available at the discretion of the Provider or rater but may not be used to verify more than six (6) items on the Inspection Checklist. This responsibility will be formally acknowledged by the builder signing-off on the Checklist for the item(s) that they verified. The column titled "N/A" should be used when the checklist item is not present in the home or when local code requirements take precedent.
4. The Checklist may be completed for a batch of homes using a RESNET-approved sampling protocol when qualifying homes as ENERGY STAR. For example, if the approved sampling protocol requires rating one in seven homes, then the Checklist will be completed for the one home which was rated.
5. In the event that a Provider or rater finds an item that is inconsistent with the Checklist Inspection guidelines, the home cannot be qualified as ENERGY STAR until the item is corrected in a manner that meets the ENERGY STAR requirements. If correction of the item is not possible, the home cannot earn the ENERGY STAR label.
6. The Provider or rater is required to keep a hard copy record of the completed and signed Checklist. The signature of a builder employee is also required if the builder verified compliance with any item on the Checklist.
7. For purposes of this Checklist, an air barrier is defined as any solid material that blocks air flow between a conditioned space and an unconditioned space, including necessary sealing to block excessive air flow at edges and seams. Additional information on proper air sealing of thermal bypasses can be found on the Building America Web site (www.eere.energy.gov/buildings/building_america) and in the EEBA Builder's Guides (www.eeba.org). These references include guidance on identifying and sealing air barriers, as well as details on many of the items included in the Checklist.



ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist

Home Address: _____		City: _____		State: _____	
Thermal Bypass	Inspection Guidelines	Corrections Needed	Builder Verified	Rater Verified	N/A
1. Overall Air Barrier and Thermal Barrier Alignment	Requirements: Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item no. 2 (<i>Walls Adjoining Exterior Walls or Unconditioned Spaces</i>)				
	All Climate Zones:				
	1.1 Overall Alignment Throughout Home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3 Attic Eave Baffles Where Vents/Leakage Exist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Only at Climate Zones 4 and Higher:				
	1.4 Slab-edge Insulation (A maximum of 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Best Practices Encouraged, Not Req'd.:				
1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Walls Adjoining Exterior Walls or Unconditioned Spaces	Requirements: <ul style="list-style-type: none"> • 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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2 Wall Behind Fireplace	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.3 Insulated Attic Slopes/Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.4 Attic Knee Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.5 Skylight Shaft Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.6 Wall Adjoining Porch Roof	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.7 Staircase Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.8 Double Walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Floors between Conditioned and Exterior Spaces	Requirements: <ul style="list-style-type: none"> • Air barrier is installed at any exposed fibrous insulation edges • Insulation is installed to maintain permanent contact with sub-floor above including necessary supports (e.g., staves for blankets, netting for blown-in) • Blanket insulation is verified to have no gaps, voids or compression. • Blown-in insulation is verified to have proper density with firm packing 				
	3.1 Insulated Floor Above Garage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2 Cantilevered Floor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Shafts	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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.2 Piping Shaft/Penetrations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	4.3 Flue Shaft	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Attic/ Ceiling Interface	Requirements: <ul style="list-style-type: none"> • 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)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.2 Attic Drop-down Stair (fully gasketed and insulated)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.3 Dropped Ceiling/Soffit (full air barrier aligned with insulation)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.4 Recessed Lighting Fixtures (ICAT labeled and sealed to drywall)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	5.5 Whole-house Fan (insulated cover gasketed to the opening)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Common Walls Between Dwelling Units	Requirements: Gap between drywall shaft wall (i.e., common wall) and the structural framing between units is fully sealed at all exterior boundary conditions				
	6.1 Common Wall Between Dwelling Units	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Home Energy Rating Provider: _____		Rater Inspection Date: _____		Builder Inspection Date: _____	
Home Energy Rater Company Name: _____		Builder Company Name: _____			
Home Energy Rater Signature: _____		Builder Employee Signature: _____			

Indoor airPLUS Verification Checklist



Address or Div/Lot#:							
City/State/Zip:			Date:				
Section			Requirements (see Indoor airPLUS Construction Specifications for details)	N/A	Builder	Rater	
Moisture Control	Water-Managed Site and Foundation						
	1.1	Site & foundation drainage: sloped grade, protected drain tile, & foundation floor drains				<input type="checkbox"/>	<input type="checkbox"/>
	1.2	Capillary break below concrete slabs & in crawlspaces (Exception - see specification)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3	Foundation wall damp-proofed or water-proofed (Except for homes without below-grade walls)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.4	Basements/crawlspaces insulated & conditioned (Exceptions - see specification)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Water-Managed Wall Assemblies						
	1.5	Continuous drainage plane behind exterior cladding, properly flashed to foundation				<input type="checkbox"/>	<input type="checkbox"/>
	1.6	Window & door openings fully flashed				<input type="checkbox"/>	<input type="checkbox"/>
	Water-Managed Roof Assemblies						
	1.7	Gutters/downspouts direct water a minimum of 5' from foundation (Except in dry climates)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.8	Fully flashed roof/wall intersections (step & kick-out flashing) & roof penetrations				<input type="checkbox"/>	<input type="checkbox"/>
	1.9	Bituminous membrane installed at valleys & penetrations (Except in dry climates)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.10	Ice flashing installed at eaves (Except in Climate Zones 1 - 4)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interior Water Management							
1.11	Moisture-resistant materials/protective systems installed (i.e., flooring, tub/shower backing, & piping)					<input type="checkbox"/>	
1.12	No vapor barriers installed on interior side of exterior walls with high condensation potential				<input type="checkbox"/>	<input type="checkbox"/>	
1.13	No wet or water-damaged materials enclosed in building assemblies				<input type="checkbox"/>	<input type="checkbox"/>	
Radon	2.1	Approved radon-resistant features installed (Exception - see specification)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2.2	Two radon test kits & instructions/guidance for follow-up actions provided for buyer (Advisory-see specification)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pests	3.1	Foundation joints & penetrations sealed, including air-tight sump covers					<input type="checkbox"/>
	3.2	Corrosion-proof rodent/bird screens installed at all openings that cannot be fully sealed (e.g., attic vents)				<input type="checkbox"/>	<input type="checkbox"/>
HVAC	4.1	HVAC room loads calculated, documented; system design documented; coils matched					<input type="checkbox"/>
	4.2	Duct system design documented & properly installed OR duct system tested (check box if tested) <input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>
	4.3	No air handling equipment or ductwork installed in garage; continuous air barrier required in adjacent assemblies					<input type="checkbox"/>
	4.4	Rooms pressure balanced (using transfer grills or jump ducts) as required OR tested (check box if tested) <input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>
	4.5	Whole house ventilation system installed to meet ASHRAE 62.2 requirements					<input type="checkbox"/>
	4.6	Local exhaust ventilation to outdoors installed for baths, kitchen, clothes dryers, central vacuum system, etc.					<input type="checkbox"/>
	4.7	Central forced-air HVAC system(s) have minimum MERV 8 filter, no filter bypass, & no ozone generators					<input type="checkbox"/>
	4.8	Additional dehumidification system(s) or central HVAC dehumidification controls installed (In warm-humid climates only)			<input type="checkbox"/>		<input type="checkbox"/>
Combustion Pollutants	Combustion Source Controls						
	5.1	Gas heat direct vented; oil heat & water heaters power vented or direct vented (Exceptions - see specifications)			<input type="checkbox"/>		<input type="checkbox"/>
	5.2	Fireplaces/heating stoves vented outdoors & meet emissions/efficiency standards/restrictions			<input type="checkbox"/>		<input type="checkbox"/>
	5.3	Certified CO alarms installed in each sleeping zone (e.g., common hallway) according to NFPA 720					<input type="checkbox"/>
	5.4	Smoking prohibited in common areas; outside smoking at least 25' from building openings (Multi-family homes only)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Attached Garage Isolation						
5.5	Common walls/ceilings (house & garage) air-sealed before insulation installed; house doors gasketed & closer installed			<input type="checkbox"/>		<input type="checkbox"/>	
5.6	Exhaust fan (minimum 70 cfm, rated for continuous use) installed in garage & vented to outdoors (controls optional)			<input type="checkbox"/>		<input type="checkbox"/>	
Materials	6.1	Certified low-formaldehyde pressed wood materials used (i.e., plywood, OSB, MDF, cabinetry)				<input type="checkbox"/>	<input type="checkbox"/>
	6.2	Certified low-VOC or no-VOC interior paints & finishes used				<input type="checkbox"/>	<input type="checkbox"/>
	6.3	Carpet, adhesives, & cushion qualify for CRI Green Label Plus or Green Label testing program			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Final	7.1	HVAC system & ductwork verified dry, clean, & properly installed					<input type="checkbox"/>
	7.2	Home ventilated before occupancy OR initial ventilation instructions provided for buyer				<input type="checkbox"/>	<input type="checkbox"/>
	7.3	Completed checklist & other required documentation provided for buyer				<input type="checkbox"/>	<input type="checkbox"/>
Rater/Provider:			Builder:				
Company:			Company:				
Signature:			Signature:				

Guidance for Completing the Indoor airPLUS Verification Checklist:

1. Only ENERGY STAR qualified homes verified to comply with these specifications can earn the Indoor airPLUS label. See Indoor airPLUS Construction Specifications for full descriptions of the requirements, terms, exceptions, abbreviations, references, and climate map used in this checklist. Verification is not complete until this checklist is completed in full and signed.
2. Check one box per line. Check “N/A” for specifications that do not apply for specific conditions (e.g., climate) according to the Exceptions described in the Indoor airPLUS Construction Specifications. Check either “Builder” or “Rater” for all other items to indicate who verified each item. Items may be verified visually on site during construction, by reviewing photographs taken during construction, by checking documentation, or through equivalent methods as appropriate. If using a performance testing alternative to meet requirement 4.2 or 4.4, the box marked “Tested” must be checked and testing documentation must be provided in the Home Energy Rating System/Builder Option Package (HERS/BOP) file.
3. The rater who conducted the verification, or a responsible party from the rater’s company, must sign the completed verification checklist. The builder must sign the checklist if any items in the “Builder” column are checked, and by so doing accepts full responsibility for verifying that those items meet Indoor airPLUS requirements.
4. The builder provides one copy of the completed and signed checklist for the buyer. The HERS/BOP provider or rater files a copy with HERS/BOP and ENERGY STAR documentation (e.g., Thermal Bypass Checklist) for the home.
5. The checklist may be completed for a batch of homes using a RESNET-approved sampling protocol when qualifying homes as ENERGY STAR. For example, if the approved sampling protocol requires rating one in seven homes, then the checklist will be completed for the one home that was rated.

Note: The Indoor airPLUS Construction Specifications are designed to help improve indoor air quality (IAQ) in new homes compared with homes built to minimum code. These measures alone cannot prevent all IAQ problems; occupant behavior is also important. For example, smoking indoors would negatively impact a home’s IAQ and the performance of the specified Indoor airPLUS measures.

Notes:

For further information on the Indoor airPLUS program, visit epa.gov/indoorairplus.



Qualified homes earn the
Indoor airPLUS label.
Place it next to the
ENERGY STAR label.



All Indoor airPLUS qualified homes meet strict
guidelines for energy efficiency set by ENERGY STAR,
the nationally-recognized symbol for energy efficiency.