Efficiency Vermont

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Proposed 2011 ENERGY STAR Specifications

Efficiency Vermont Comments

July 1, 2009

Sam Rashkin
ENERGY STAR for Homes Program
US Environmental Protection Agency
1200 Pennsylvania Ave NW
Washington, DC 20460

Dear Sam,

Efficiency Vermont has completed an initial review of the proposed 2011 ENERGY STAR® Specifications. The new proposal is a timely and significant step forward for the ENERGY STAR program and would result in homes that are more durable and healthy in addition to being more energy efficient. We are glad to see the bar has been raised. Efficiency Vermont does, however, have concerns about the cost of implementing the new standard for both builders and sponsoring ENERGY STAR program providers, especially relative to the modest gains in energy efficiency that the new specification would yield in Vermont. Below, please find a summary of: **1)** changes we see as positive; **2)** areas that will be challenging for builder implementation; **3)** areas that will be challenging for program sponsor implementation; **4)** general recommendations; and **5)** detailed comments on specifications and checklists (attached).

Efficiency Vermont provides energy efficiency services for Vermonters, and is delivered by the Vermont Energy Investment Corporation under contract to the Vermont Public Service Board. Efficiency Vermont is funded by a surcharge on all electric bills in Vermont and provides the "Vermont ENERGY STAR Homes" service at no cost to enrollees. Maximizing electrical savings is therefore a key consideration in any program Efficiency Vermont decides to implement. Efficiency Vermont has also been involved in the development of comments with RESNET, the Consortium for Energy Efficiency (CEE), and Northeast HERS Alliance.

1. POSITIVE CHANGES

A) Addressing house size

The concept of a size adjustment factor is a positive step towards bringing energy use down in larger homes and raising awareness that house size has an impact on overall energy use.

B) Homes built to the new spec will result in more durable, comfortable, energy efficient homes and promote market transformation in the right direction.

C) Changes to the ENERGY STAR standard will represent a higher level of energy efficiency than many states' current energy codes.

D) The new standard will result in an increase in electrical savings on a national level with new HVAC, lighting, and appliance requirements. It should be noted though that the new standard won't create such an increase in Vermont due to our already high level of ENERGY STAR products.

2. BUILDER CHALLENGES

A) Education

There are a number of builders in Vermont who could readily adopt the new standard with minimal training and guidance. However the vast majority would need significant education- both in terms of what's required in the new standard and how to build to that standard. This would hold true for building subcontractors as well given the expanded checklist requirements. Builders will need to have a clear understanding of what's expected of them before an ENERGY STAR project gets underway, and be willing to acquire the knowledge needed to achieve the new ENERGY STAR standard.

B) Cost

According to EPA's "2011 Fact Sheet", there is an anticipated $4,000 - $5,000 incremental cost increase for building to the new 2011 ENERGY STAR standard. While this is cost effective over the life of the house, we anticipate significant builder pushback given that many builders are trying to keep up-front costs down, especially in a slow market. Many Vermont builders have permits in-hand and are waiting for an upward swing in the housing market to begin building. If these homes are not completed within the phase-in period established by the EPA, they will likely need to renegotiate contracts for services and reconsider products in order to meet the new ENERGY STAR standard.

The cost increase for builders may be significantly more at the beginning of this program due to many subcontractors charging more for work they are not accustomed to doing (ex. installing HVAC equipment in the manner required by ENERGY STAR specs). Of greatest concern is that the verification costs for complying with the new checklists may be significant, and an added cost many builders aren't used to carrying.

While it's difficult to determine how these factors will play out in the marketplace, there is a strong likelihood that we could lose many currently participating builders who are not willing to invest the additional time and resources required to meet the new standard. We will need to assess how this anticipated attrition would impact our services and ability to achieve energy savings goals.

3. PROGRAM SPONSOR IMPLEMENTATION CHALLENGES

A) Educating the market about the new standard (raters, builders, subcontractors, architects)

In order to effectively implement the new standard, significant resources will be required to train raters, builders, subcontractors, and architects. Even with EPA's promise of providing information through trainings and publications, inevitably

much of the education will take place in the field. This will require program staff to first get up to speed on program specifics, then be able to provide builders and subcontractors with the information they need to meet ENERGY STAR requirements. In Vermont, we work with many small-scale builders, and even our large developers are small in comparison to the rest of the US. Local field trainings and workshops will therefore be necessary for a wide range of builders and subcontractors due to the increased scope of the new specification. Quality reference materials produced by EPA will be essential in this education effort. A determination will need to be made as to how raters will be trained in the details of the new specification and who will lead that training effort- EPA? RESNET? Regional groups like the Northeast Home Energy Rating Systems Alliance (NE HERS Alliance)?

Particular challenges we face in educating the market include: explaining the performance path to builders given the complexity in determining the target by modeling a reference design home modified by size adjustment factor; developing expertise on HVAC quality installation practices and testing for central AC given that Vermont is a heating climate; and explaining the new checklists and verification procedures.

B) Justifying increased implementation costs given Efficiency Vermont's principal mandate to reduce demand for electricity

Efficiency Vermont is primarily funded through a charge on Vermonters' electricity bills. We will need to make sure the energy savings we claim justify the extra resources spent in implementing the new standard, or we will need to pass some of the implementation costs on to participants. Passing on costs to participants could lead to a negative public impression (I already pay for this on my electric bill) and reduce participation significantly. This is especially true if the extra time required on each project limits our ability to work on the same volume of projects as we have in the past. Aspects of the new spec that don't directly tie in with decreased energy use like water managed construction and air quality will need to be evaluated as to whether they should be part of our core service.

C) Completing the required checklists in two site visits

The increase in the number and diversity of checklist requirements as currently presented will make it challenging to complete the checklists in two site visits. There is often wide variation in construction timelines depending on the builder, time of year, type of project (development vs. custom home) and other factors which are out of the control of the energy rater. Even now with the current Thermal Bypass Inspection Checklist, there are often times when elements of the checklist can't be verified at pre-drywall inspection or final inspection. Adding more checklists will make the "two site visit standard" even more challenging. Providing more opportunities for builder sign-off will be necessary, especially on the Water Managed Construction Checklist. This particular checklist may be more appropriate as a full builder checklist (much like the Contractor's HVAC checklist), or offered as an optional part of the program.

D) Maintaining a high level of program participation

Marketing to builders and homeowners ways in which the benefits of the new standard outweigh the costs will be critical to the program's future

success. Owners of a house built to 2011 ENERGY STAR specifications will be assured of a high quality home. However if we expect builders to incorporate the new criteria into standard building practice, both builders and homeowners will need to recognize the value of each new ENERGY STAR requirement. Change can be difficult- many builders will need to be persuaded that the extra time and money spent building to the ENERGY STAR standard is a worthwhile investment.

4. General Recommendations

A) Develop a fixed HERS index target score for each benchmark home size, and make the target more stringent.

Our average HERS index in Vermont is currently 62, largely due to common practice installation of high efficiency heating systems and ducts much tighter than the current reference home. Initial modeling based on an ENERGY STAR Reference Design Home built to the 2011 specification indicates that it would achieve a HERS score in the 70s, even after applying the size adjustment factor. Vermont builders are already performing well beyond this level, and Efficiency Vermont would like the flexibility to set a more stringent HERS target score that would promote higher levels of energy efficiency performance.

We also recommend a consistent, fixed target HERS index. It is much easier to convey a fixed target when talking to builders, and raters would more easily be able to apply the Size Adjustment Factor when applicable. Additionally, the methodology as currently proposed would require two stages of modeling – one for the reference home and one for the actual home. This could represent an increase in time given that the modeling would need to be performed on the front end during plan review, while often Efficiency Vermont raters are doing the modeling later in the process.

RESNET's recommendation to create a target index for each benchmark home size is a good place to start. Their proposal suggests that the HERS index for each benchmark home size reflect the minimum 15% over code energy savings that is the stated goal of the ENERGY STAR program. A lower target index coupled with a more rigorous size adjustment factor would result in lower and more equitable energy consumption across homes of all sizes.

B) Reduce the checklist requirements for raters so that they can be completed in two site visits.

The additional requirements and checklists will result in higher builder, subcontractor, homeowner and rater verification costs, likely resulting in program attrition. Efficiency Vermont has additional concerns that the checklist requirements as currently presented cannot be completed in two site visits. Through RESNET and CEE phone conferences with EPA, our understanding is that EPA shares the desire to have a two site visit standard. Our raters estimate that it would actually take 4-6 site visits to complete the checklists as written. That level of on site activity isn't feasible within a rural state like Vermont. In order for Efficiency Vermont to continue implementing the ENERGY STAR program at its current participation level, and deliver it free of charge to customers, we need to be able to verify the checklists in no more than two site visits. The Water Managed Construction checklist is especially challenging, and only has the opportunity for 3 builder verified signoffs. We suggest limiting the scope of the 2011

spec so that it does not expand into other green building or code areas, or offer a voluntary labeling approach to non-energy/IAQ issues. At minimum, have the Water Managed Construction checklist be the builder's responsibility, and provide more builder signoff options on other checklists so that raters have a better chance of completing the checklists at the pre-drywall inspection and final inspection.

The HVAC checklists are also problematic in Vermont, given their focus on central air conditioning rather than heating systems. In Vermont, we aim for building design that avoids the need for central AC or that locates all ducts within conditioned space. We also recommend that instead of making the HVAC checklists mandatory, offer a choice. If a builder wants full credit for nameplate SEER of installed CAC equipment, they need to do the checklist. If no checklist is submitted, they take a hit on the efficiency. This 'hit' factor would need to be developed by the RESNET tech committee, but would be something around 3 SEER points based on previous analysis.

(Please see attached checklists for more detailed checklist comments).

C) Alter the Size Adjustment Factor to more closely match energy consumption of larger homes and smaller homes.

Efficiency Vermont recommends that the 2011 ENERGY STAR size adjustment criteria come closer to achieving EPA's stated goal of having the energy consumption of large ENERGY STAR labeled homes more closely match an average sized ENERGY STAR labeled home. The method in place for adjusting the target index score is reasonable, but we would like to see the result of the calculation be an adjusted target index much lower (requiring higher efficiency) than as drafted. Our preliminary recommendation is to allow local program sponsors some flexibility to set the size adjustment factor within an acceptable range, for example:

$SAF = [CFA_{Benchmark\ Home} / CFA_{Home\ To\ Be\ Built}]^{0.5 - 0.85}$, ***not to exceed 1.0*** where the **n value** is set somewhere between 0.5 and 0.85.

D) Allow flexibility for states to adopt standards more stringent than those set by EPA.

On the CEE conference call, it was mentioned that states would have the ability to adopt ENERGY STAR standards more stringent than those set by EPA. Efficiency Vermont would like to have the flexibility to create a fixed baseline HERS index lower than that set by the EPA in order to push for more energy savings measures in every participating home. We would also like the flexibility to utilize a Size Adjustment Factor more stringent than what is currently being proposed. This increased flexibility would allow us to require HERS scores that challenge Vermont builders and bring energy use in larger homes down to a level more consistent with smaller homes. We would appreciate any guidance from EPA on how these alterations to the program could be achieved.

E) Incorporate ENERGY STAR reference home requirements into rating software.

The final spec changes need to be fully vetted before rolling them out into the marketplace, including development of tools to support the changes.

F) Provide more opportunity for performance measurement as alternative to prescriptive requirement (example HVAC QI Rater checklist 2.10; IAQ 2.5).

G) Produce publications and presentation templates that can be used in builder and subcontractor trainings.

Quality training resources will be critical to the success of the program. We expect that much of the builder training will happen on a regional and local basis. Any resources that can make these trainings run smoothly will be invaluable.

H) Clarify definitions, modeling procedures, and multifamily applications.

The new spec provides a great opportunity to define "Conditioned Floor Area" vs. "Finished Floor Area" to achieve consistency between RESNET, ENERGY STAR, codes and software use. We would also like to see how the new requirements will be applied in multifamily projects- how many stories and what types of central/individual conditioning systems apply? How is the benchmark home size equated for multifamily?

I) Ensure that spec requirements are implementable in all climate zones throughout the year.

Provide guidance on labeling of homes during the winter in situations where checklist items can not be verified. An example would be not being able to properly complete HVAC checklist when an AC unit is not fully installed until spring. Review the spec for other weather-related hurdles.

5. Specific Specification Suggestions and Comments. Please see notes on specific requirements in attached 2011 ENERGY STAR draft documents.

Efficiency Vermont believes the overall goals of the new 2011 ENERGY STAR specification are commendable and are pushing the national new construction market in the right direction. In Vermont, we're concerned that minimal extra energy savings will be achieved since most homes already incorporate significant installations of ENERGY STAR lighting, appliances, and heating systems and score well below the proposed HERS Index score (target and size-adjusted). We anticipate a significant increase in implementation costs, and the challenge will be delivering this program in a cost-effective manner while maintaining a high level of participation. Because of the significant resources needed to train raters, builders, and subcontractors on new aspects of the program and implementation of the new checklists, Efficiency Vermont will need to assess whether the 2011 ENERGY STAR standard is the best vehicle for achieving desired energy savings in Vermont. We appreciate the opportunity to provide feedback to the EPA and look forward to seeing the final specifications in the coming months.

Thank you for taking our comments into consideration.

Sincerely,

Efficiency Vermont 2011 ENERGY STAR Working Group

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DRAFT ENERGY STAR Qualified Homes 2011 National Program Requirements

To qualify as ENERGY STAR, a home shall meet the minimum requirements specified below, be verified and field-tested in accordance with HERS Standards by a Rater,[1] and meet all applicable codes. Builders may select either the performance path or the prescriptive path and meet its corresponding requirements to qualify a home.

ENERGY STAR Prescriptive Path

The prescriptive path provides a single set of measures that can be used to construct an ENERGY STAR qualified home. Modeling is not required, but no tradeoffs are allowed. Follow these steps to use the prescriptive path:

1. First assess eligibility of using the prescriptive path by comparing the conditioned floor area (CFA) of the home to be built to the CFA of the Benchmark Home, as specified in Exhibit 3. The CFA of the Benchmark Home is determined based on the number of bedrooms in the home to be built. If the CFA of the home to be built exceeds this value, then the performance path shall be used.
2. If the home to be built is eligible to follow the prescriptive path, build the home using the mandatory requirements for all qualified homes, Exhibit 1, and all requirements of the ENERGY STAR Reference Design, Exhibit 2.
3. Verify that all requirements have been met using a Rater.

ENERGY STAR Performance Path

While all mandatory requirements in Exhibit 1 are required, the performance path provides flexibility to select a custom combination of measures that is equivalent in performance to the ENERGY STAR Reference Design Home, Exhibit 2. This is achieved with energy modeling that allows measures to be optimized for each particular home or builder. Follow the steps below to use the performance path with RESNET-accredited Home Energy Rating software programs:

1. The HERS Index of the ENERGY STAR Reference Design Home is first determined. The ENERGY STAR Reference Design Home is similar to the home that will be built, except that it is configured with the features summarized in Exhibit 2[2]. Note that any state energy code requirements that exceed those specified in Exhibit 2 take precedence for purposes of configuring the ENERGY STAR Reference Design Home[3].
2. A Size Adjustment Factor (SAF) is next calculated using the following equation:

   $$SAF = [CFA_{Benchmark\ Home} / CFA_{Home\ To\ Be\ Built}]^{0.25}, \text{ not to exceed } 1.0$$

   Where:

   $CFA_{Benchmark\ Home}$ = Conditioned Floor Area of the Benchmark Home, using Exhibit 3
   $CFA_{Home\ to\ be\ Built}$ = Conditioned Floor Area of the Home to be Built

   Because the Size Adjustment Factor cannot exceed 1.0, it only modifies the HERS Index for homes with conditioned floor area that exceeds that of the Benchmark Home.
3. The ENERGY STAR HERS Index Target is calculated next[4]:

   ENERGY STAR HERS Index Target = HERS Index of ENERGY STAR Reference Design Home x SAF
4. Configure the preferred set of energy measures for the rated home and verify that the resulting HERS Index meets or exceeds the ENERGY STAR HERS Index Target, as defined in Step 3.
5. Construct the home using measures that result in a HERS Index at or below the ENERGY STAR HERS Index Target, calculated above, and the mandatory requirements for all qualified homes, Exhibit 1.
6. Verify that all requirements have been met using a Rater.

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Exhibit 1: ENERGY STAR Mandatory Requirements for All Qualified Homes[3,5]

Area of Improvement	Mandatory Requirements
1. Envelope	☐ Completed Thermal Bypass Inspection Checklist ☐ Completed Quality Framing Checklist
2. Cooling & Heating System	☐ Completed HVAC Quality Installation Contractor Checklist ☐ Completed HVAC Quality Installation Rater Checklist
3. Water Efficiency	☐ Average flow-rate for all shower-heads shall be ≤ 2.0 gallons per minute ☐ Hot water distribution system shall use demand pumping, manifold, or core layout
4. Lighting & Appliances	☐ All installed refrigerators, dishwashers, and clothes washers shall be ENERGY STAR qualified[6] ☐ Advanced Lighting Package (ALP), or ENERGY STAR bulbs in 80% of sockets, shall be installed[7] ☐ All installed bathroom exhaust and ceiling fans shall be ENERGY STAR qualified
5. IAQ & Durability	☐ Completed Indoor Air Quality Checklist ☐ Completed Water-Managed Construction Checklist

Exhibit 2: ENERGY STAR Reference Design[2, 3, 5]

Hot Climates (2006 IECC Zones 1,2,3)[8]	**Mixed and Cold Climates** (2006 IECC Zones 4,5,6,7,8)[8]
Cooling Equipment (Where Provided)	
• ≥ 14.5 SEER / 12 EER ENERGY STAR qualified AC; OR • Heat pump (See Heating Equipment)	• ≥ 13 SEER AC; OR • Heat pump (See Heating Equipment)
Heating Equipment	
• 80 AFUE gas / oil furnace; OR • 80 AFUE boiler; OR • ≥ 8.2 HSPF / 14.5 SEER / 12 EER ENERGY STAR qualified heat pump	• 92 AFUE gas furnace, ENERGY STAR qualified; OR • 85 AFUE boiler, ENERGY STAR qualified; OR • 85 AFUE oil furnace, ENERGY STAR qualified; OR • ≥ 8.5 HSPF / 14.5 SEER / 12 EER ENERGY STAR qualified heat pump[9]
Envelope, Windows, & Doors	
• If more than 10 linear feet of ductwork are located in an unconditioned attic, a radiant barrier shall be installed.[10]	• Radiant barrier not required
• Insulation levels shall meet or exceed the 2009 IECC and achieve Grade I installation, per RESNET standards.[11] • Infiltration[12] (ACH50): 7 in CZs 1,2 | 6 in CZs 3,4 | 5 in CZs 5,6,7 | 4 in CZ 8 • ENERGY STAR qualified or better windows and doors (additional requirements for CZ2 and CZ4)[13,14,15,16]	
Water Heater[17, 18]	
• Gas (EF): 30 Gal = 0.63 | 40 Gal = 0.61 | 50 Gal = 0.59 • Electric (EF): 52 Gal = 0.92 | 66 Gal = 0.90 | 80 Gal = 0.89 • Water heater systems that are integrated with a space-heating boiler may be used in place of a stand-alone system. However, an integrated indirect storage system shall be used rather than an integrated tankless coil system.	
Thermostat[19] **& Ductwork**	
• ENERGY STAR qualified thermostat (except for zones with radiant heat) shall be installed. • Ducts in unconditioned attics shall have insulation ≥ R-8; All other ducts in unconditioned spaces shall have insulation ≥ R-6. [20] • Duct leakage to outdoors shall be ≤ 4 CFM per 100 sq. ft. of conditioned floor area. [21, 22]	
Lighting & Appliances	
• For purposes of calculating the ENERGY STAR HERS Index Target, homes shall be modeled with an ENERGY STAR dishwasher, ENERGY STAR refrigerator, ENERGY STAR ceiling fans, and ENERGY STAR bulbs in 80% of sockets [2].	

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Exhibit 3: Benchmark Home Size[23]

Bedrooms in Home to be Built	1	2	3	4	5	6	7	8
Conditioned Floor Area Benchmark Home	1,000	1,600	2,200	2,800	3,400	4,000	4,600	5,200

Notes:

1. The term "Rater" refers to the person completing the third-party inspections required for qualification. Depending on the compliance path selected, this party may be a certified Home Energy Rater, BOP Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET.

2. For a complete definition of the reference design to be used when determining the ENERGY STAR HERS Index Target under the performance path, see the document titled "ENERGY STAR Reference Design Definition" located on EPA's website. Note that this definition assumes a framing fraction of 17% for exterior walls and 7% for ceilings, a mechanical ventilation system, window area and orientation as defined in footnote 15 of this document, and other important details.

3. State energy code specifications that exceed the ENERGY STAR National Program Requirements shall take precedence in determining ENERGY STAR compliance requirements, in the following manner. In states with both performance and prescriptive compliance paths for their energy codes, the prescriptive path specifications shall be used for comparing rigor to the ENERGY STAR National Program Requirements. In Exhibit 1, state energy code specifications that exceed Mandatory Requirements shall take precedence. In Exhibit 2, the ENERGY STAR Reference Design shall be modified to include any prescriptive requirement that is more rigorous than the level currently specified. In states with only a performance compliance path, EPA will provide corresponding modifications to the ENERGY STAR Reference Design in Exhibit 2. This modified Reference Design shall then be used to calculate the HERS Index of the ENERGY STAR Reference Design Home.

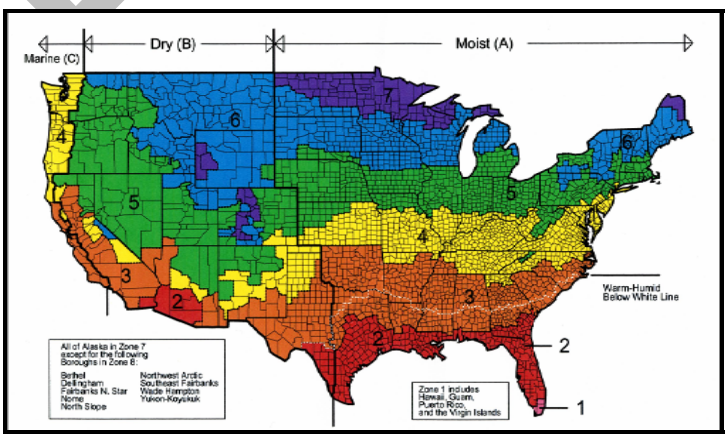
4. On-site power generation may only be used to meet the ENERGY STAR HERS Index Target for homes that are larger than the Benchmark Home and only for the incremental change in ENERGY STAR HERS Index Target that's caused by the size-adjustment factor.

5. Due to the unique nature of the Hawaiian climate, EPA offers a regionally-developed definition of ENERGY STAR for that state.

6. Further efficiency and savings can be achieved by installing ENERGY STAR qualified products in addition to those required.

7. To learn about the benefits of meeting this requirement through the installation of an ENERGY STAR Advanced Lighting Package (ALP), refer to www.energystar.gov/alp.

8. The following Map is shown to depict climate zone boundaries. It is for illustrative purposes only and is based on 2006 IECC Figure 301.1.



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9. Homes with heat pumps in Climate Zones 4 through 8 shall have an HSPF ≥ 8.5, which exceeds the ENERGY STAR minimum of 8.2 HSPF. EPA recommends, but does not require, that air-source heat pumps not be used in Climate Zones 6, 7, and 8.

10. Any radiant barrier with a minimum reflectance of 0.90 and maximum emittance of 0.10 or an ENERGY STAR qualified roof product meets the requirement for a radiant barrier.

11. Insulation levels in a home shall meet or exceed those specified in the 2009 IECC. Compliance can be determined by meeting prescriptive insulation requirements, by using U-factor alternatives, or by using a total UA alternative. Note that the U-factor for steel-frame envelope assemblies shall be calculated using the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method. Additionally, 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 Rater.

12. Envelope leakage shall be determined by a Rater using a RESNET-approved testing protocol.

13. All windows, skylights, and doors shall be ENERGY STAR qualified or meet latest specifications. Windows in Climate Zones 2 and 4 shall exceed ENERGY STAR specifications:

    CZ 2: U-value ≤ 0.55 and SHGC ≤ 0.35;
    CZ 4: U-value ≤ 0.40 and SHGC ≤ 0.45.

    Note that the ENERGY STAR window specification is currently under revision. It is EPA's intent to align the ENERGY STAR Homes specification with this revised specification upon its release. Visit www.energystar.gov/windows for the latest information on ENERGY STAR qualified windows and doors.

14. All decorative glass and skylight window areas count toward the total window area to above-grade conditioned floor area (WFA) ratio. For homes using the prescriptive path that have a WFA ratio >18%, the following additional requirements apply:

    a. In 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.

    b. In 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.

15. When determining the ENERGY STAR HERS Index Target under the performance path, the home shall be modeled with windows evenly distributed to four cardinal compass orientations (N, E, S, & W) and with total window area equal to 18% of conditioned floor area, except as follows - for homes with conditioned basements and for multi-family attached homes the following formula shall be used to determine total window area:

    $$AF = 0.18 \times AFL \times FA \times F$$

    Where:
    - AF = Total fenestration area
    - AFL = Total floor area of directly conditioned space
    - FA = (Above-grade thermal boundary gross wall area) / (Above-grade boundary wall area + 0.5 x Below-grade boundary wall area)
    - F = 1- 0.44* (Common wall area) / (Above-grade thermal boundary wall area + Common wall area)

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And where:

- Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions;
- Above-grade thermal boundary wall is any portion of a thermal boundary wall not in contact with soil;
- Below-grade boundary wall is any portion of a thermal boundary wall in soil contact; and
- Common wall is the total wall area of walls adjacent to another conditioned living unit, not including foundation walls.

For a complete definition of the reference design to be used when determining the ENERGY STAR HERS Index Target under the performance path, see the document titled "ENERGY STAR Reference Design Definition" located on EPA's website.

16. 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.

17. In addition to the options provided to enhance builder choices for water heating, EPA encourages builders to consider using water heaters that earn the ENERGY STAR.

18. 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).

19. In homes with heat pumps, programmable thermostats shall have "Adaptive Recovery" technology to prevent the excessive use of back-up heating.

20. 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.

21. Duct leakage shall be determined and documented by an EPA-approved verifier using a RESNET-approved or equivalent ASTM-approved testing protocol.

22. If total duct leakage is less than the required value, 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.

23. The average-size home with a specific number of bedrooms is termed "Benchmark Home". A bedroom is defined as a room or space 70 square feet or greater, with egress window and closet, used or intended to be used for sleeping. A "den", "library", or "home office" with a closet, egress window, and 70 square feet or greater or other similar rooms shall count as a bedroom, but living rooms and foyers shall not. The conditioned floor area of a Benchmark Home (CFA Benchmark Home) is determined by selecting the appropriate value from Exhibit 3. For homes with more than 8 bedrooms, the CFA Benchmark Home shall be determined by multiplying 600 sq. ft. times the number of bedrooms and adding 400 sq. ft.

    Example: CFA Benchmark Home for a 10 bedroom home = (600 sq. ft. x 10) + 400 sq. ft. = 6,400 sq. ft.

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DRAFT ENERGY STAR Qualified Homes 2011 Inspection Checklists

To qualify as ENERGY STAR, a home must meet the requirements of the six attached checklists:

- Thermal Bypass Inspection Checklist
- Quality Framing Checklist
- HVAC Quality Installation Contractor Checklist
- HVAC Quality Installation Rater Checklist
- Indoor Air Quality Checklist
- Water-Managed Construction Checklist

A home must also meet the other requirements of either the performance or the prescriptive path, meet the mandatory requirements for all qualified homes, be verified and field-tested in accordance with HERS Standards by a Rater[1], and meet all applicable codes. State, local, and regional code requirements that are more rigorous than those specified should always take precedence. In addition, state, local, and regional code requirements; engineering calculations; manufacturers' installation instructions; and regional ENERGY STAR program requirements that conflict with the scopes of work specified supersede the items in these checklists.

Raters are expected to use their experience and discretion in verifying that each checklist item is installed per the inspection guidelines (i.e., identifying minor defects that the Rater deems acceptable versus identifying major defects that undermine the intent of the checklist item).

Alternative methods of meeting the checklist requirements may be used if the Provider deems them to be equivalent to or more stringent than the checklist guidelines. The column titled "N/A," which denotes items that are "not applicable," should be used when the checklist item is not present in the home or when code, engineering, manufacturer, or regional program requirements take precedence.

In the event that an item on the checklist cannot be inspected by the Rater, the home cannot be qualified as ENERGY STAR. The only exceptions to this rule are in the Thermal Bypass Inspection and Water-Managed Construction Checklists, where the builder may assume responsibility for verifying that a small subset of items have met the requirements of those checklists. This option is only at the discretion of the Rater, and may not be used to verify more than the permissible number of items specified in each checklist (i.e., four for the Thermal Bypass Inspection Checklist and three for the Water-Managed Construction Checklist). When exercised, the builder's responsibility will be formally acknowledged by the builder signing off on the checklist for the item(s) that they verified.

The checklists may be completed for a batch of homes using a RESNET-approved sampling protocol to qualify homes as ENERGY STAR. For example, if the approved sampling protocol requires rating one in seven homes, then all of the checklists must be completed for the one required rating.

In the event that a Rater finds an item that is inconsistent with the checklist guidelines, the home cannot be qualified as ENERGY STAR until the item is corrected. If correction of the item is not possible, the home cannot earn the ENERGY STAR.

The Rater is required to keep hard copies of the completed and signed checklists. The builder's signature is also required if the builder verified compliance with any item on the two applicable checklists. The signature of the HVAC technician is required if any of the HVAC equipment specified on the HVAC Quality Installation Contractor Checklist is installed in the home.

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Rater Name: _____

Rater Company Name: _____

Builder Company Name: _____

HVAC Company Name: _____

ENERGY STAR Qualified Homes 2011
Inspection Checklist Notes

1. The term "Rater" refers to the person completing the third-party inspections required for qualification. Depending on the compliance path selected, this party may be a certified Home Energy Rater, BOP Inspector, or an equivalent designation as determined by a Verification Oversight Organization such as RESNET.

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ENERGY STAR Qualified Homes 2011
Thermal Bypass Inspection Checklist

Home Address: _____ City: _____ State: _____

Thermal Bypass	Inspection Guidelines[1]	Must Correct	Builder Approved[2]	Rater Approved	N/A
1. Overall Air Barrier and Thermal Barrier Alignment	Insulation installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item 2, *Walls Adjoining Exterior Walls or Unconditioned Spaces*				
	All Climate Zones				
	1.1 Overall alignment of insulation throughout home	☐	☐	☐	☐
	1.2 Grade I insulation installation	☐	☐	☐	☐
	1.3 Garage band joist air barrier in place[3]	☐	☐	☐	☐
	1.4 Attic eave baffles in place where vents/leakage exist[4]	☐	☐	☐	☐
	Climate Zones 4 and Higher				
	1.4 Slab edge insulation properly installed	☐	☐	☐	☐
	Best Practices Encouraged, but Not Required				
	1.5 Air barrier in place at all band joists[5]	☐	☐	☐	☐
2. Walls Adjoining Exterior Walls or Unconditioned Spaces	• Fully insulated wall aligned with air barrier at both interior and exterior, **OR**; • Alternate for Climate Zones 1 through 3, sealed exterior air barrier aligned with fully supported RESNET Grade I insulation • Continuous top and bottom plates in place or sealed blocking used				
	2.1 Walls insulated behind showers and tubs	☐	☐	☐	☐
	2.2 Walls insulated behind fireplaces	☐	☐	☐	☐
	2.3 Attic slopes and walls insulated	☐	☐	☐	☐
	2.4 Attic knee walls insulated	☐	☐	☐	☐
	2.5 Skylight shaft walls insulated	☐	☐	☐	☐
	2.6 Wall adjoining porch roof insulated	☐	☐	☐	☐
	2.7 Staircase walls insulated	☐	☐	☐	☐
	2.8 Double walls insulated	☐	☐	☐	☐
3. Floors Between Conditioned and Exterior Spaces	• Air barrier installed at any exposed fibrous insulation edges • Insulation installed to maintain permanent contact with sub-floor above, including necessary supports[6] • Blanket insulation verified to have no gaps, voids, or compression • Blown-in insulation verified to have proper density with firm packing				
	3.1 Floor insulated above garage	☐	☐	☐	☐
	3.2 Cantilevered floors insulated	☐	☐	☐	☐
4. Shafts	Openings to unconditioned space fully sealed with solid blocking or flashing and any remaining gaps sealed with caulk or foam (fire-rated collars and caulking installed where required)				
	4.1 Duct shafts sealed	☐	☐	☐	☐
	4.2 Piping shafts and penetrations sealed	☐	☐	☐	☐
	4.3 Flue shafts sealed	☐	☐	☐	☐
5. Attic / Ceiling Interface	• All surfaces and dropped ceilings include a full interior-side air barrier aligned with insulation • All penetrations and gaps fully sealed with caulk, foam, or tape and any flashing as required				
	5.1 Sheetrock to top plate at all attic/wall interfaces fully sealed	☐	☐	☐	☐
	5.2 Attic access panels and drop down stairs sealed[7]	☐	☐	☐	☐
	5.3 Dropped ceilings and soffits sealed	☐	☐	☐	☐
	5.4 Airtight recessed lighting fixtures installed[8]	☐	☐	☐	☐
	5.5 Whole-house fans have insulated cover gasketed to opening	☐	☐	☐	☐
6. Common Walls Between Dwelling Units	Gap between drywall shaft wall (i.e., common wall) and the structural framing between units fully sealed at all exterior boundary conditions				
	6.1 Common wall between dwelling units sealed	☐	☐	☐	☐

Rater Name: _____ Rater Inspection Date: _____ Rater Initials: _____

Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____

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ENERGY STAR Qualified Homes 2011
Thermal Bypass Inspection Notes

1. For purposes of this checklist, an air barrier is defined as any solid material that blocks air flow between conditioned space and 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.
2. At the discretion of the Rater, the builder may verify no more than four items specified in this checklist. When exercised, the builder's responsibility will be formally acknowledged by the builder signing off on the checklist for the item(s) that they verified.
3. Air barriers shall be installed at bays adjoining conditioned space.
4. Wind baffles shall be installed in every bay at eaves for attics with ceiling insulation.
5. An air barrier at all band joists is recommended but not required in Climate Zones 4 and higher.
6. Examples of necessary supports include staves for batt insulation or netting for blown-in insulation.
7. Attic access panels and attic drop-down stairs must be fully gasketed and insulated.
8. Recessed lighting fixtures must be ICAT labeled and sealed to the drywall.

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ENERGY STAR Qualified Homes 2011
Quality Framing Checklist & Notes

Home Address: _____ City: _____ State: _____

Inspection Guidelines		Must Correct	Rater Approved	N/A
1. Attic Framing	1.1 Raised-heel truss installed in the attic [1]	☐	☐	☐
	1.2 Raised platform installed for HVAC air handler [2]	☐	☐	☐
2. Exterior Above-Grade Walls	2.1 Optimum Value Engineered (OVE) framing including all of the below:			
	2.1.1 All corners insulated to edge [3], **AND**;	☐	☐	☐
	2.1.2 All headers above windows & doors insulated [4], **AND**;	☐	☐	☐
	2.1.3 Framing limited at all windows & doors [5], **AND**;	☐	☐	☐
	2.1.4 All interior / exterior wall intersections insulated [6], **AND**;	☐	☐	☐
	2.1.5 Unnecessary studs have been eliminated [7], **OR**;	☐	☐	☐
	2.2 Continuous insulated sheathing, **OR**;	☐	☐	☐
	2.3 Structural Insulated Panels (SIPs), **OR**;	☐	☐	☐
	2.4 Insulated Concrete Forms (ICFs), **OR**;	☐	☐	☐
	2.5 Double wall framing [8]	☐	☐	☐

Rater Name: _____ Rater Inspection Date: _____ Rater Initials: _____

1. Raised-heel trusses shall elevate the roof adequately for full-depth attic insulation at the attic perimeter. Alternatively, construct a conditioned attic.
2. HVAC air handler platform in unconditioned attics shall be framed to allow full-depth insulation below.
3. All exterior corners shall have insulation extend to exterior wall sheathing using either “California Corners” (i.e., two studs in ‘L’ configuration with furring or drywall clips as needed to support drywall) or equivalent alternative framing technique.
4. Minimum R-5 insulated headers shall be provided with prefabricated insulated headers, two-ply headers with insulation between, single-ply headers insulated on one side, or equivalent assembly.
5. Framing at windows shall be limited to a maximum of two king/jack studs to support the header and window sill and the use of additional jack studs only as needed for structural support.
6. Insulation shall run continuously behind interior/exterior wall intersections using ladder blocking, full length 2”x6” or 1”x6” furring behind the first partition stud, drywall clips, or other equivalent alternative.
7. Continuous vertical framing member extending from the bottom plate to the top plate shall ***not*** be adjacent to any other such framing member unless specified in structural engineered framing layout. In addition, spacing of framing shall conform to specifications on construction documents except for variations needed to accommodate apertures and plan dimensions.
8. Double walls shall include two independently framed walls with all framing offset and continuous insulation except at windows, doors and other penetrations.

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ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Contractor Checklist[1,2]

Home Address: _____ City: _____ State: _____

Equipment Specification, Design, and Documentation		
1. Equipment	1.1 Condenser mfr., model, & serial #:	
	1.2 Evaporator mfr., model, & serial #:	
	1.3 ARI reference number:	
2. Design	2.1 Heat gain calculation method compliant with Manual J or equivalent, using the following assumptions? [1]	Yes / No
	2.1.1 Outdoor design temperature: a) 99.0% design as published in ASHRAE Handbook of Fundamentals, OR b) Based on prevailing local practice reflecting documented weather data	 Yes / No Yes / No
	2.1.2 Indoor setpoint set at 75°F	Yes / No
	2.1.3 Infiltration rate set at 'Tight'	Yes / No
	2.2 Duct design method compliant with Manual D or equivalent?[3]	Yes / No
	2.3 Equipment specification method compliant with Manual S or equivalent?[3]	Yes / No
	2.4 Terminal design method compliant with Manual T or equivalent?[3]	Yes / No
	2.5 In warm, humid counties in Climate Zones 1 - 3, equipment's sensible heat ratio ≤ 0.70 or stand-alone ENERGY STAR qualified dehumidifier installed?[4]	Yes / No / N/A
	2.6 Corrosion-resistant drain pan, properly sloped to drainage system[5]	Yes / No
3. Documentation	3.1 ARI certificate attached?	Yes / No

Field Verification		**Design Value**	**Field Value**	**Variance In Values**
4. Equipment Capacity	4.1 Latent heat gain (Btu/h):[6]			
	4.2 Sensible heat gain (Btu/h):[6]			
	4.3 Total heat gain (Btu/h):[6]			
5. Air Flow	5.1 Airflow at evaporator (CFM):[6,7]			
	5.2 Duct static pressure – supply (WC):[6]			
	5.3 Duct static pressure – return (WC):[6]			
	5.4 Fan motor type (fixed speed, variable speed):			N/A
	5.5 Fan speed setting (CFM):[6]			
6. Refrigerant Charge [8]	6.1 Refrigerant type (R-22, R-410a):			N/A
	6.2 Metering device (TXV, fixed orifice):			N/A
	6.3 Return air temp. (°F dry bulb / °F wet bulb):[9]	N/A		N/A
	6.4 Supply air temp. (°F dry bulb / °F wet bulb):[9]	N/A		N/A
	6.5 Outdoor ambient air temp. at condenser (°F dry bulb):	N/A		N/A
	6.6 Liquid line temperature & pressure (°F / psi):	N/A		N/A
	6.7 Suction line temperature & pressure (°F / psi):	N/A		N/A
	6.8 Condensing temperature (°F):[10]	N/A		N/A
	6.9 Evaporating temperature (°F):[11]	N/A		N/A
	6.10 *For non-Lennox TXV devices:* Subcooling temp. (condensing temp – liquid line temp.)[12]			
	6.11 *For Lennox TXV devices:* Approach temp. (liquid line temp.– outdoor ambient temp.)[13]			
	6.12 *For fixed orifice devices:* Superheat temp. (suction line temp. – evaporating temp.)[14]			

Technician Name: _____ Equipment Installation Date: _____

Technician Signature: _____ Company Name: _____

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ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Contractor Notes

1. This checklist applies to split air conditioners, unitary air conditioners, and air-source/water-source heat pumps up to 65,000 Btu/h. All other equipment is exempt.
2. This checklist shall be provided by the Rater to the HVAC contractor who shall complete one checklist for each system. Upon completion, the HVAC contractor shall return the checklist(s) to the Rater for review.
3. Cooling loads shall be calculated, equipment capacity shall be selected, and duct systems shall be sized according to the latest editions of ACCA Manuals J, S, D, & T, respectively, ASHRAE 2005 Handbook of Fundamentals or an equivalent procedure. Maximum oversizing limit for air conditioners and air-source and ground-source heat pumps is 15% with the exceptions that single-speed air-source and ground-source heat pumps in buildings with heating loads that exceed cooling loads have a limit of 25%; and multi-stage heat pumps do not have a strict limit, but should be sized to allow adequate humidity control in the cooling mode. The following operating conditions must be used in the sizing calculations:

   Outdoor temperatures must 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 must be 75°F for cooling, and;

   Infiltration rate must be selected as "tight", or the equivalent term.

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

4. Equipment shall have a sensible heat ratio ≤ 0.70 or an ENERGY STAR qualified stand-alone dehumidifier must be installed in home. This requirement applies only to homes that are located in both Climate Zones 1, 2 or 3 and in Warm, Humid counties as identified by Tables N1101.2 and N1101.2.1 of the 2004 Supplement to the IRC, respectively.
5. Corrosion-resistant materials include stainless steel and plastic. Drain pan shall drain condensate line to drainage system, rather than just depositing underneath foundation.
6. Measured field value shall be within 5% of design value.
7. Measured air volume shall be determined using a "true flow" anemometer or pressure matching (i.e., duct blaster).
8. Climate conditions, such as cold weather, may make it impossible to verify proper refrigerant charge. In such cases, a TXV must be installed.
9. Air temperatures shall be measured in ducts near evaporator and not in conditioned building space.
10. Calculated using liquid line pressure measured value.
11. Calculated using suction line pressure measured value.
12. Field value must be within 3°F of design value.
13. Field value must be within 1°F of design value.
14. Field value must be within 5°F of design value.

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ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Rater Checklist

For Raters Only: The HVAC Quality Installation Contractor Checklist must be completed by the HVAC contractor. Please review the checklist using the form below to help ensure that the equipment was installed to design specifications.

Home Address:_____ City: _____ State: _____

Inspection Guidelines	Must Correct	Rater Approved	N/A
1. Review of HVAC Quality Installation Contractor Checklist			
1.1. Checklist completed in its entirety	☐	☐	☐
1.2 Compliance with Manual J, S, D, and T or equivalents indicated	☐	☐	☐
1.3 Compliance with SHR or dehumidifier requirement indicated	☐	☐	☐
1.4 Required outdoor / indoor temperature and infiltration rate assumptions used to complete Manual J calculations	☐	☐	☐
1.5 ARI certificate attached	☐	☐	☐
1.6 Reported equipment capacity field values within 5% of design values	☐	☐	☐
1.7 Reported air flow field values within 5% of design values	☐	☐	☐
1.8 Reported duct static pressure field values within 5% of design values	☐	☐	☐
1.9 Reported design fan motor type same as field fan motor type	☐	☐	☐
1.10 Reported fan speed field values within 5% of design values	☐	☐	☐
1.11 Reported refrigerant charge and metering device field types same as design types	☐	☐	☐
1.12 For Non-Lennox TXV devices, reported sub-cooling temperature deviation within +/- 3°F of goal	☐	☐	☐
1.13 For Lennox TXV devices, reported approach temperature deviation +/- 1°F of goal	☐	☐	☐
1.14 For Fixed Orifice devices, reported superheat temperature deviation +/- 5°F of goal	☐	☐	☐
2. Duct Quality Installation			
2.1 Connections and routing of ductwork completed without kinks or bends > 90° [1]	☐	☐	☐
2.2 No excess coiled or looped flexible ductwork[1]	☐	☐	☐
2.3 No compression of flexible ductwork[1]	☐	☐	☐
2.4 Flexible ducts supported at intervals as recommended by manufacturer but at a distance not > 5 ft. and with maximum sag of 0.5 in. per ft. of spacing between supports[1]	☐	☐	☐
2.5 All connections to trunk ducts in unconditioned space insulated	☐	☐	☐
2.6 Building cavities not used as return ducts	☐	☐	☐
2.7 Ducts in unconditioned attics have insulation ≥ R-8; All other ducts in unconditioned space have insulation ≥ R-6.[2]	☐	☐	☐
2.8 Total duct leakage ≤ 6 CFM per 100 sq. ft. of conditioned floor area	☐	☐	☐
2.9 Duct leakage to outdoors ≤ 4 CFM per 100 sq. ft. of conditioned floor area[2,3,4]	☐	☐	☐
2.10 Bedrooms pressure-balanced such that 1 sq. in. of opening is provided per 1 CFM of supply air. Dedicated return ducts, transfer grills, and/or jump ducts may be used to meet this requirement.	☐	☐	☐

Rater Name: _____ Date Checklist Inspected: _____

Rater Signature: _____ Rater Company Name: _____

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ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Rater Notes

1. Scope of work applies to all HVAC and ventilation ductwork.
2. 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.
3. Duct leakage shall be determined and documented by a Rater using a RESNET-approved or equivalent ASTM-approved testing protocol.
4. If total duct leakage is less than the required value, 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.

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ENERGY STAR Qualified Homes 2011
Indoor Air Quality Checklist

Home Address: _____ City: _____ State: _____

System	Inspection Guidelines			Must Correct	Rater Approved	N/A
Ventilation[1]						
1. Whole-Building Delivered Ventilation[2]	1.1 Ventilation rate meets requirements of ASHRAE Std. 62.2 2007, Section 4.4			☐	☐	☐
	1.2 In hot-humid climates, net exhaust flow ≤ 7.5 CFM per 100 sq. ft.			☐	☐	☐
	1.3 In very cold climates, net supply flow ≤ 7.5 CFM per 100 sq. ft.			☐	☐	☐
2. Local Mechanical Exhaust	System installed in each kitchen and bathroom and meets one of the following airflow standards:					
	Location	**Continuous Rate:**	**Intermittent Rate:**[3]			
	2.1 Kitchen	≥ 5 ACH, based on kitchen volume[4]	≥ 100 CFM	☐	☐	☐
	2.2 Bathroom	≥ 20 CFM	≥ 50 CFM	☐	☐	☐
	2.3 If fans share common exhaust duct, back-draft dampers installed			☐	☐	☐
	2.4 Common exhaust duct not shared by fans in separate dwellings			☐	☐	☐
	2.5 Total net exhaust flow of two largest exhaust fans (excluding summer cooling fans) is ≤ 15 CFM / 100 sq. ft. of occupiable space when at full capacity[5]			☐	☐	☐
	2.6 Clothes dryers exhaust vented directly to outdoors[6]			☐	☐	☐
3. Fan Sound Ratings[7]	3.1 Continuous fans rated at ≤ 1 sone at minimum rated flow rate			☐	☐	☐
	3.2 Intermittent fans rated at ≤ 3 sone, unless maximum rated flow rate ≥ 400 CFM			☐	☐	☐
4. Controls	4.1 Continuously-operating ventilation system and mechanical exhaust fans designed to operate without occupant intervention during all occupiable hours			☐	☐	☐
	4.2 Readily accessible override controls provided to occupant for continuously-operating ventilation system and mechanical exhaust fans			☐	☐	☐
	4.3 If present, intermittently-operating ventilation system designed to automatically operate at least one hour out of every twelve			☐	☐	☐
	4.4 Controls labeled, unless function is obvious (e.g., bathroom exhaust fan)			☐	☐	☐
5. Air Inlets & Ventilation Source	5.1 Air inlets located ≥ 10 ft. from stack, vent, exhaust hood, or vehicle exhaust and ≥ 3 ft. from dryer exhaust			☐	☐	☐
	5.2 Air inlets unable to be obstructed by snow, plantings, or other material			☐	☐	☐
	5.3 Air inlets provided with mesh rodent / insect screen with openings ≤ 0.5 in.			☐	☐	☐
	5.4 Ventilation air comes directly from outdoors and not from adjacent dwelling units, garages, unconditioned crawlspaces, or attics			☐	☐	☐
Combustion Pollutants						
6. Garage Isolation	6.1 Air-handler and return ducts *not* located within the garage			☐	☐	☐
	6.2 Garage doors adjacent to occupiable spaces gasketed or made airtight			☐	☐	☐
7. Appliances and Detectors	7.1 No ventless combustion appliances installed, except for kitchen cooking devices			☐	☐	☐
	7.2 One carbon monoxide detector, certified by CSA 6.19-01 or UL 2034, installed in central location near sleeping areas for homes with combustion appliances or attached garage[8]			☐	☐	☐
Filtration						
8. HVAC Filter	8.1 ≥ MERV 8 filter installed in ducted mechanical systems[9]			☐	☐	☐
	8.2 Filter located so that return and ventilation air pass through prior to conditioning			☐	☐	☐
	8.3 Filter accessible for maintenance by owner			☐	☐	☐
	8.4 Filter rack fitted with flexible, air-tight gasketing on the [illegible]ce that contacts the downstream side of the filter, or equivalent method			☐	☐	☐
	8.5 Filter held firmly in place by friction-fit spring clips in the filter rack, installed on the upstream side of the filter, or equivalent method			☐	☐	☐

Rater Name: _____ Rater Inspection Date: _____ Rater Initials: _____

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ENERGY STAR Qualified Homes 2011
Indoor Air Quality Notes

1. For proper procedures, exceptions, selection methods, and alternate methods to the Indoor Air Quality Checklist, see the ASHRAE Standard 62.2 - 2007. All components shall be designed and installed per manufacturers' requirements and local codes.
2. The system shall have at least one supply or exhaust fan with associated ducts and controls. Local exhaust fans are allowed to be part of an exhaust ventilation system. Outdoor air ducts connected to the return side of an air handler are allowed to be part of a supply ventilation system if manufacturers' requirements for return air temperature are met. The airflow required by this standard refers to the delivered airflow of the system as installed and tested using a flow hood, flow grid, or other airflow measuring device.
3. An intermittent mechanical exhaust system where provided shall be designed to operate as needed by the occupant. Control devices shall not impede occupant control in intermittent systems.
4. A vented range hood, or appliance-range hood combination, is required if exhaust fan flow rate is < 5 kitchen ACH.
5. If net exhaust flow exceeds allowable limit, net exhaust flow shall be reduced or compensating outdoor airflow provided. Net exhaust flow requirement is exempted if no atmospherically vented combustion or solid-fuel burning appliances are located inside the pressure boundary.
6. Electric condensing dryers equipped with condensate drain need not be vented.
7. Fans exempted from this requirement include HVAC air handlers and remote-mounted fans (i.e., fans outside habitable spaces and with ≥ 4 ft. ductwork between fan and intake grills.)
8. Carbon monoxide detectors shall be placed according to NFPA 720 and be hard-wired with a battery back-up function.
9. Manufacturer filter media boxes designed to accomplish these purposes meet these requirements.

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ENERGY STAR Qualified Homes 2011
Water-Managed Construction Checklist

Home Address: _____ City: _____ State: _____

Assembly	Inspection Guidelines	Must Correct	Builder Approved[1]	Rater Approved	N/A
1. Water-Managed Foundation	1.1 Patio slabs, walks, and driveways sloped ≥ 0.25 in. per ft. away from home	☐	☐	☐	☐
	1.2 Final grade sloped ≥ 0.5 in. per ft. away from home for ≥ 10 ft. back-fill tamped to prevent settling[2]	☐	☐	☐	☐
	1.3 Capillary break beneath all concrete slabs using either:[3] • 4 in. bed of ≥ 0.5 in. clean aggregate covered with sheeting in direct contact with the concrete slab above, OR; • 4 in. uniform layer of sand overlaid with geotextile drainage matting and covered with sheeting	☐	☐	☐	☐
	1.4 Capillary break for all crawlspace floors using either:[4] • Concrete slab over lapped polyethylene sheeting, OR; • 6 mil polyethylene sheeting, lapped 6-12 in. and sealed at seams, attached to walls and piers with adhesive and furring strips	☐	☐	☐	☐
	1.5 Exterior surface of below-grade walls finished as follows: • For poured concrete, concrete masonry, and insulated concrete forms, finish with damp-proofing coating • For wood framed walls, finish with trowel-on mastic and polyethylene or other equivalent waterproofing	☐	☐	☐	☐
	1.6 Interior surface of below-grade walls *not* finished with continuous vapor barrier	☐	☐	☐	☐
	1.7 Sump pump covers shall be air-sealed (i.e., mechanically attached with full gasket seal or equivalent)	☐	☐	☐	☐
	1.8 Protected drain tile surrounded with clean gravel and fabric filter[5]	☐	☐	☐	☐
2. Water-Managed Wall Assembly	2.1 Flashing at bottom of exterior walls with weep holes included for masonry veneer and weep screed for stucco cladding systems[6]	☐	☐	☐	☐
	2.2 Fully sealed continuous drainage plane behind exterior cladding that laps over flashing in Section 2.1[7]	☐	☐	☐	☐
	2.3 Window and door openings fully flashed[8]	☐	☐	☐	☐
3. Water-Managed Roof Assembly	3.1 Step and kick-out flashing at all roof-wall intersections, extending ≥ 4" on wall surface above roof deck and integrated with drainage plane above[9]	☐	☐	☐	☐
	3.2 Guttering and downspouts empty to lateral piping that deposits water on sloping finish grade ≥ 5 ft. from foundation or to underground catchment system ≥ 10 ft. from foundation[10,11]	☐	☐	☐	☐
	3.3 Self-sealing bituminous membrane or equivalent at all valleys and roof decking penetrations	☐	☐	☐	☐
	3.4 In IECC 2006 Climate Zones 5 and higher, self-sealing bituminous membrane or equivalent over sheathing at eaves, extending ≥ 2 ft. up roof deck	☐	☐	☐	☐
4. Building Materials	4.1 Wall-to-wall carpet *not* installed adjacent to toilets and bathing fixtures (e.g., tubs and showers)	☐	☐	☐	☐
	4.2 Cement board or equivalent moisture-resistant backing material installed behind tub and shower enclosures[12]	☐	☐	☐	☐
	4.3 Piping in exterior walls installed with insulation	☐	☐	☐	☐
	4.4 In Humid-Hot and Humid-Mixed climates, permeability rating of finishes used on interior side of exterior walls is > 1	☐	☐	☐	☐
	4.5 Building materials with visible signs of water damage or mold *not* installed	☐	☐	☐	☐
	4.6 Interior walls *not* enclosed (e.g., with drywall) if either the framing members or insulation products have high moisture content[13]	☐	☐	☐	☐

Rater Name: _____ Rater Inspection Date: _____ Rater Initials: _____

Builder Employee: _____ Builder Inspection Date: _____ Builder Initials: _____

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ENERGY STAR Qualified Homes 2011
Water-Managed Construction Notes

1. In the event that an item cannot be inspected by the Rater, the builder may assume responsibility for verifying that the item has met the requirements of the checklist. This option is available at the discretion of the Rater but may not be used to verify more than three (3) items on the checklist. This responsibility will be formally acknowledged by the builder signing off on the checklist for the item(s) that they verified.
2. Where setbacks limit space to less than 10 ft., provide swales or drains designed to carry water from foundation. Backfill tamping is not required if proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.
3. Sheeting shall be ≥ 6 mil polyethylene sheeting overlapped 6-12 in. at joints. Polyethylene sheeting is not required in Dry (B) climates as defined by IECC 2004 Figure 301.1, except in U.S. EPA Zone 1 Radon areas. In areas with free-draining soils, identified as Group 1 in the IRC by a certified hydrologist, soil scientist, or engineer through a site visit, a gravel layer or geotextile matting is not required.
4. It is recommended, but not required, that sheeting be ≥ 10 mil polyethylene. Polyethylene sheeting is not required for raised-pier foundation with no walls, in Dry (B) climates as defined by IECC 2004 Figure 301.1, or in Marine climates as defined by IECC 2004 Figure 301.1 and Table 301.1 if no air handler or return ducts are installed in the crawlspace.
5. Protected drain tile shall be installed at the footings of basement and crawlspace walls, level or sloped to discharge to outside grade (daylight) or to a sump pump. The top of each drain tile pipe shall always be below the bottom of the concrete slab or crawlspace floor. Each pipe shall be surrounded with at least 6 inches of ½ to ¾ inc. washed or clean gravel. The gravel layer shall be fully wrapped with fabric cloth to prevent fouling of the drain tile.
6. Drainage systems equivalent to flashing are also allowed.
7. Any of the following systems may be used: a monolithic weather-resistant barrier (i.e., house wrap) sealed or taped at all joints; weather resistant sheathings (e.g., faced rigid insulation) fully taped at all “butt” joints; or lapped shingle-style building paper or felts.
8. Include pan flashing at sills, side flashing that extends over pan flashing, and top flashing that extends over side flashing.
9. Intersecting wall siding shall terminate 1 in. above the roof, or higher per manufacturer's recommendations. Continuous flashing shall be installed in place of step flashing for metal and rubber membrane roofs.
10. Not required in dry climates as shown in IECC 2004 Figure 301.1 and Table 301.1.
11. Roof design without gutters is also acceptable if it deposits rainwater to a grade-level rock bed with a waterproof liner and a drain pipe that deposits water on a sloping finish grade ≥ 5 ft. from foundation. Rainwater harvesting systems may also be used to meet this requirement when designed to properly drain overflow, meeting the discharge-distance requirements above.
12. Paper-faced wall board does not meet this requirement.
13. For wet-applied insulation products, follow manufacturer’s drying recommendations. As guidance, note that lumber should not exceed 18% moisture content.

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