EarthCraft House™ Technical Guidelines
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Introduction

About EarthCraft

EarthCraft™ green building programs, which were first developed in 1999 as a partnership between the Greater Atlanta Home Builders Association and Southface Energy Institute, are designed to specifically address the challenging energy, water and climate conditions of the Southeast.

EarthCraft certification helps ensure that buildings and communities in the region meet strict criteria for saving energy and water, ensuring high indoor air quality, and protecting our land and natural resources. To achieve an EarthCraft certification, a building is required to undergo independent third-party verification by a qualified EarthCraft Technical Advisor who confirms the building meets all program requirements.

The family of EarthCraft green building programs includes:

EarthCraft House
The EarthCraft House™ program is designed to certify new construction single-family detached homes, townhomes and duplexes. Any size or type of home can be certified because builders are able to select which program measures are best suited for the project while meeting minimum thresholds for performance.

EarthCraft Renovation
EarthCraft Renovation™ offers remodelers and contractors the unique opportunity to certify projects of various size and complexity in renovation, remodeling and expansion. Renovation projects receive an assessment and recommendations for specific renovation techniques to address environmental performance areas.

EarthCraft Multifamily
The EarthCraft Multifamily™ program is designed to certify new or renovated low-rise, mid-rise and high-rise residential buildings. Multifamily projects are designed to address environmental performance, livability and affordability for each unit as well as the structure as a whole.

EarthCraft Communities
The EarthCraft Communities™ program is designed to certify sustainably planned and developed communities in urban, suburban or rural areas. The program offers a holistic approach to sustainable development projects.

EarthCraft Light Commercial
The EarthCraft Light Commercial™ program is designed to certify new or renovated small-scale commercial buildings of 15,000 square feet or less. Projects receive hands-on support during the design and construction process that focuses on energy- and water-efficient design strategies.

About the EarthCraft House Technical Guidelines

The EarthCraft House Technical Guidelines apply to all new construction and gut rehab projects in the EarthCraft House program, including single-family homes, duplexes and townhomes. The Technical Guidelines must be used in conjunction with the EarthCraft House Worksheet and are intended to provide explanations for each line item on the Worksheet.

Projects seeking additional clarity beyond what is provided in the Technical Guidelines shall consult an EarthCraft Technical Advisor for additional information.
All local building codes must be met. When local building codes are more stringent than the Technical Guidelines and Worksheet, the local code must be followed. Should the EarthCraft Technical Guidelines and Worksheet conflict with local code, the local code must be followed. The EarthCraft Builder must notify the EarthCraft Technical Advisor of any changes required for the home to meet local codes.

Additions and updates are made by EarthCraft to the Technical Guidelines as needed and requested. Technical Guidelines versions may be determined by the version date in the lower left corner of the document. The latest Technical Guidelines are available for free download from www.viridiant.org. To make recommendations for improvements and updates to the Technical Guidelines, please contact Viridiant or an EarthCraft Technical Advisor.

**Legend**

The Technical Guidelines are organized by category. Each line item on the EarthCraft Worksheet is listed in the Technical Guidelines with the following supplemental information. To determine which line items are required by the program and the point values associated with line items, the EarthCraft Worksheet must be reviewed.

**Criteria**

Criteria cover the requirements for the specified measure detailing any specific information necessary for meeting the line item. All criteria must be implemented to qualify for the line item on the EarthCraft House Worksheet.

Materials and methods described are representative of typical strategies that meet the intent of the criteria, but do not represent all strategies that may be used. The builder may request permission from EarthCraft, through the EarthCraft Technical Advisor, to meet the intent of the credit using a different approach; approval must be requested and approved prior to implementation.

Line items with multiple options will be identified through the use of numbers or letters in italics with specific criteria associated with each number or letter. Numbered items indicate criteria that may be added together on the EarthCraft House Worksheet for cumulative points; Lettered items indicate criteria that may not be added together (the project may only receive credit for one of the options listed). For example, under SP1.0: Type of Site, all three measures (1, 2 and/or 3) may be met or only one measure may be met as a site can be a brownfield, previously developed and an infill site, or it may only be one of those. SP 1.1: Ratio of Lot Size to Conditioned Floor Area, only one item, either A, B, C or D, may be counted towards EarthCraft certification.

**Clarifications**

Clarifications provide case-specific clarifications of criteria implementation, such as trade-offs allowed within the program.

**Exemptions**

Exemptions list specific exemptions to credit requirements.

**Examples**

Examples provide examples of criteria implementation and are often used to demonstrate calculations.

**Additional Resources**

Additional Resources are intended to provide a quick reference for applicable resources that may be used for additional information pertaining to criteria. Additional Resources are not intended to be an exhaustive list of references and products that may be used to meet criteria.
Confirmation

When verifying line items on an EarthCraft project, EarthCraft Builders and EarthCraft Technical Advisors shall reference the guidelines to ensure all requirements have been met. The Confirmation language articulates when the official confirmation activity should take place and how, and whether any documentation is required. All criteria must be confirmed before points are awarded on the EarthCraft House Worksheet.

Confirmation occurs primarily at either the pre-drywall inspection, the final inspection, or at both the pre-drywall inspection and final inspection. Each confirmation type confirms compliance of criteria as listed in the criteria and clarifications sections of each line item. The type(s) of confirmation is listed based on a set of standard options as follows:

- **Visual**
  - Indicates confirmation of criteria via direct visual inspection by the EarthCraft Technical Advisor.
  - The type of visual confirmation required is dependent on the criteria and shall at a minimum include a direct visual inspection by the EarthCraft Technical Advisor to confirm criteria were met. For example, if the project is pursuing credit for recycling waste, in addition to reviewing the documented waste management plan provided by the builder, the EarthCraft Technical Advisor will visually confirm that materials are being recycled on site by seeing recycling signage and separation piles and confirming no materials meant for recycling are in the trash (e.g., no contractor beverage containers are in the dumpster).
  - If unable to confirm compliance of criteria through this option, the EarthCraft Technical Advisor may require documentation or photo confirmation.

- **Verbal**
  - Indicates confirmation of criteria via direct conversation between the builder and EarthCraft Technical Advisor.
  - The type of verbal confirmation required is dependent on the criteria and shall at a minimum include a reasonable explanation by the builder of how the criteria were met.
  - If unable to confirm compliance of criteria through this option, the EarthCraft Technical Advisor may require documentation or photo confirmation.
  - If the EarthCraft Technical Advisor identifies any discrepancy between the verbal description provided and visual inspections performed on the project, the visual confirmation rules. For example, if the builder verbally confirms all waste was disposed of in a state approved landfill, but the EarthCraft Technical Advisor sees a bury-pit on site, the home will not be eligible for certification.

- **Documentation**
  - Indicates confirmation of criteria via documentation provided by the builder and reviewed by the EarthCraft Technical Advisor.
  - The type of documentation required is dependent on the criteria. For example, criteria dependent on calculations shall be demonstrated through the documentation of those calculations. Other common forms of documentation include: site plans, house plans, product specifications, product warranties, test results, etc. The documentation must provide sufficient information for the EarthCraft Technical Advisor to confirm the criteria were met and shall not require the EarthCraft Technical Advisor to conduct further research or calculations.
o Documentation, as specified in the confirmation area for each line item, may either be:
  ▪ Presented at or before the applicable inspection and kept on file by the builder for a minimum of three years.
  ▪ Submitted to the EarthCraft Technical Advisor at or before the applicable inspection and kept on file by the EarthCraft Technical Advisor for a minimum of three years.

o Documentation applicable to multiple projects may be presented and/or submitted once and kept on file by the appropriate party. Updates to documentation are required whenever methods or materials used are changed. EarthCraft Technical Advisors are required to verbally reconfirm documentation accuracy at each inspection.

o When criteria are clearly met through visual inspection the EarthCraft Technical Advisor may wave documentation. For example, if the EarthCraft Technical Advisor visually confirms cork flooring has been installed on 30% of the floor area, s/he may wave documentation.

  ▪ Photo
    o Indicates confirmation of criteria via photo documentation provided by the builder and reviewed by the EarthCraft Technical Advisor.
    o Photos must be submitted by the builder to the EarthCraft Technical Advisor at or before the applicable inspection and kept on file by the EarthCraft Technical Advisor for a minimum of three years.
    o Photos must clearly illustrate criteria being confirmed as well as location in the project.
    o Additional photo documentation guidelines can be found in the EarthCraft House Manual.

  ▪ Testing
    o Indicates confirmation of criteria via diagnostic testing performed primarily by the EarthCraft Technical Advisor. Tests not performed by the EarthCraft Technical Advisor, must be performed by a third-party approved by the EarthCraft Technical Advisor and not having a direct conflict of interest. For example, HVAC flow testing must be performed by a third-party not associated with the HVAC contractor. The EarthCraft Technical Advisor must review test results for reasonableness.
    o Proper industry-accepted training and testing protocol must be followed in addition to the specific measures outlined in the following guidelines, including properly calibrated and maintained equipment. Specific examples of industry-accepted testing protocols that must be followed in addition to the guidelines include:
      ▪ Flow testing: the third-party must use a properly calibrated flow hood, flow grid or anemometer in accordance with relevant AABC, NEBB or ASHRAE procedures.
      ▪ Blower door and duct leakage testing: the third-party must follow RESNET standards.
About the EarthCraft House Worksheet and Manual

Objective

The EarthCraft House Worksheet and the EarthCraft House Manual provide project teams with detailed information and guidance on program implementation. The EarthCraft House Worksheet is an Excel spreadsheet that can be downloaded from www.viridiant.org. It is used to show compliance with EarthCraft House development criteria, and includes a cover sheet indicating the project’s score, a worksheet illustrating which strategies the project has incorporated, a test sheet to document blower door and duct leakage testing results, and an inspection notes tab. The EarthCraft Manual describes the roles and responsibilities of all project participants and outlines the process of certifying a home.

Instructions

The EarthCraft Builder must complete an EarthCraft worksheet showing that the project will qualify for certification. Each project for which a builder seeks certification must have a completed worksheet unique to the home.

The EarthCraft Builder must download the most recent worksheet from the EarthCraft website before new homes seek verification of program compliance and before each design review. The builder analyzes the project prior to construction and selects the points they anticipate earning by placing an appropriate score next to each point value. The EarthCraft Technical Advisor reviews the worksheet at the Design Review, Pre-Drywall Inspection and Final Inspection to clarify any questions that arise during implementation, collect the required documentation (varies per line item) and verify specific measures (varies per line item).

Disclaimer and Notices

EarthCraft authorizes you to view the EarthCraft House Technical Guidelines (Technical Guidelines) for your individual use and to copy as-is, or in part as needed. No content may be altered. In exchange for this authorization, you agree to retain all copyright and other proprietary notices contained in the Technical Guidelines. You also agree not to sell or modify the Technical Guidelines.

Also, please note that none of the parties involved in the funding or creation of the Technical Guidelines, including EarthCraft, Viridiant, Southface, the Greater Atlanta Home Builders Association and all associated members, make any warranty (express or implied) or assume any liability or responsibility, to you or any third parties for the accuracy, completeness, or use of, or reliance on, any information contained in the Technical Guidelines, or for any injuries, losses or damages (including, without limitation, equitable relief) arising out of such use or reliance.

As a condition of use, you covenant not to sue, and agree to waive and release EarthCraft, Viridiant, Southface, the Greater Atlanta Home Builders Association and all associated members from any and all claims, demands and causes of action for any injuries, losses or damages (including, without limitation, equitable relief) that you may now or hereafter have a right to assert against such parties as a result of your use of, or reliance on, the Technical Guidelines.

Please note that the builder (or primary project manager) is solely responsible for choosing the EarthCraft House criteria that are appropriate for the home and for their proper installation. Viridiant and its representatives are responsible only for verifying the completion of EarthCraft requirements as set forth in the Technical Guidelines.
Guidelines; such verification in no way constitutes a warranty as to the appropriateness of the selected EarthCraft criteria or the quality of implementation.

**Acknowledgements**

EarthCraft would like to thank the support of our many government, industry and private sponsors and partners that help with the development and continued refinement of the EarthCraft Technical Guidelines. U.S. Department of Energy:

- U.S. Environmental Protection Agency
- Georgia Environmental Facilities Authority
- EarthCraft Sponsors
- EarthCraft Technical Advisors
- EarthCraft Builders
- The countless other individuals that have provided feedback and shared information with EarthCraft.

For a current list of EarthCraft Sponsors, EarthCraft Technical Advisors, and EarthCraft Builders, please visit: www.viridian.org.

If you would like to offer recommendations for refinement or improvement, please send comments to admin@viridian.org.

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- Fax......................................................... 804-562-4159
- Mailing Address........................................ 1431 West Main Street
  Richmond, VA 23220
Site Planning

The location of a home and the plan for the area around that home can have a significant impact on both a resident’s quality of life and on the environment. Selecting an appropriate site for a home is essential to creating more walkable, livable communities with efficient transportation. One can also improve the air quality in a neighborhood, help manage storm water, lower energy bills and increase property values simply by protecting and restoring trees on a site. Planning for construction on a site can prevent soil loss and water pollution by reducing erosion and properly controlling for storm water.

The Site Planning category of the EarthCraft program focuses on actions that a builder can take to minimize the direct impact of a building site on the environment. These actions range from protecting excavated topsoil from erosion to reducing lot size. Projects may also implement additional site planning measures to promote accessibility to public amenities such as mass transit and parks or using degraded sites such as brownfields.

Site Selection

SP 1.0 Type of site

Criteria

1. Previously developed site
   Build home on lot that has preexisting paving or construction on ≥75% of site.

2. Infill site
   Build home on lot that is served by existing public sewer infrastructure and ensure that 75% of lot boundary is adjacent to parcels of land previously developed for ≥5 years time. Natural areas or corridors are not considered previously developed. If the property boarders a road, the land use on the opposite side of the road from the property shall be used.

Additional Resources

Technical assistance for building on brownfield sites may be obtained by contacting the Environmental Protection Agency’s (EPA) Division of Waste Management: http://www.epa.gov/brownfields/tools/index.htm.

Confirmation

- The EarthCraft Technical Advisor will visually confirm criteria compliance at pre-drywall inspection.

SP 1.1 Lot size ≤1/4 acre

Criteria

- Build home on lot less than 1/4 acre.

Example

- Acre= 43,560 sq ft
- Lot size= 1/4 acre (10,890 sq ft)
SP 1.2 Located within a community that provides municipal recycling pick-up or within 10 miles of a recycling center drop-off.

Criteria
Locate home within a community that provides municipal recycling pick-up or within 10 miles of a recycling center drop-off station.

Confirmation
The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection. The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

Site Design

SP 2.0 Connectivity

Criteria

1. **Walking distance to bus line (≤1/4 mile)**
   Locate the primary entrance of the home within 1/4 mile of an existing bus line. Measure distance by following a walkable route comprised of sidewalks, public trails and pedestrian crosswalks.

2. **Walking distance to rail/rapid transit (≤1/2 mile)**
   Locate the primary entrance of the home within 1/2 mile of an existing light rail/heavy rail rapid transit station. Measure distance by following walkable route comprised of sidewalks, public trails and pedestrian crosswalks.

3. **Biking distance to bike path (≤1/2 mile)**
   Locate the primary entrance of the home within 1/2 mile of an existing or new bike path. Measure distance by following bikeable route.

4. **Walking distance to public openspace or greenspace ≥3/4 acre in size (≤1/4 mile)**
   Locate the primary entrance of the home within 1/4 mile of a park that is available for homeowner use and greater than 3/4 acre in size. Measure distance by following a walkable route comprised of sidewalks, public trails and pedestrian crosswalks. Two smaller parks equivalent in size to one large, 3/4 acre park, are accepted as meeting the intent.

5. **Walking distance to 4 or more mixed uses (≤1/4 mile)**
   Locate the primary entrance of the home within 1/4 mile of an existing business district. Measure distance by following walkable route comprised of sidewalks and pedestrian crosswalks. Business district must have at least 4 or more distinct community resources (e.g., one library, one school, one grocery store and one restaurant).
**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

---

**SP 2.1 Permanent stormwater control**

**Criteria**
Control disturbed site area by integrating Low Impact Development Best Management Practices (LID BMP) into the project. All BMPs shall be properly located to drain away from building foundation to protect home from moisture damage.

1. Direct impervious surface runoff to appropriately sized rain gardens, swales, drywells or bio-retention areas. Receiving area soils shall be amended to increase infiltration to the level required for maintaining storm water. Keep area protected from heavy machinery and parking during construction or mitigate soil compaction post construction.

2. Design and install rooftop gardens and green roofs.

3. Direct roof or site runoff into rain barrels and cisterns. Size barrels and cisterns appropriately and enable use of water for building reuse or landscape irrigation.

Use the LID manual for designing rain gardens, swales or bioretention areas (if applicable to the project). Provide the permanent stormwater management plan with scale clearly indicating: area of disturbed site, permeable and impermeable surfaces, and type and location of LID BMPs used. This plan can be integrated into the site plan, landscape plan or erosion control plan. Rain event at bioretention areas shall be sized per the Georgia Stormwater Manual’s water quality control parameters, or other state equivalent guideline.

A. ≥25% of onsite impervious surface areas
Projects must disconnect at least 25% of onsite impervious surface areas from storm drains by implementing some or all of the LID BMPs from the list above.

B. ≥75% of onsite impervious surface areas
Projects must disconnect at least 75% of onsite impervious surface areas from storm drains by implementing some or all of the LID BMPs from the list above. Clarifications

Landscape installation plan must be consistent with the LID BMPs selected for the project.

Alternative LID BMPs may be approved by EarthCraft prior to use.

**Example**
- 1,100 sq ft roof
- 150 sq ft pervious drive way
- 1,100 sq ft impervious surface total
- 530 sq ft of the roof drains to rain barrels sized appropriately
- 300 sq ft of the roof drains into a downspout and into a rain garden
In total, 880 sq ft (80%) of the 1,100 sq ft of impervious surface area drains to an LID BMP.

Additional Resources:
- http://www.lid-stormwater.net
- www.georgiastormwater.com

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and visually confirm compliance of criteria at pre-drywall inspection.

### Site Preparation and Preservation Measures

#### SP 3.0 Workshop on erosion and sediment control (site super w/ current certification)

**Criteria**
Site supervisor must attend and pass examination for either the “Fundamentals of Erosion Control and Sedimentation” workshop or the “Structural and Vegetative Design for Erosion and Sediment Control” workshop, or equivalent offered by the local Soil and Water Conservation Commission.

Site supervisor must inform all subcontractors of the Erosion and Sedimentation Control Plan.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

#### SP 3.1 Site assessment identifying all greenspace features

**Criteria**
Develop a site assessment plan (site plan, aerial photo or sketch) that identifies all greenspace features such as wetlands, stream banks/riparian buffers, steep slopes (15% or greater) and existing trees of 3” caliper or greater. Analyze which areas can be saved via reorientation of building and staging of construction materials and activities.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

#### SP 3.2 Erosion and sedimentation control plan with implementation

**Criteria**
Create an Erosion and Sedimentation Control Plan consistent with state or local best management practices.
Include, at a minimum, the following measures:

- Perimeter fencing installed and maintained properly to control runoff and siltation.
- Storm sewer inlets protected with straw bales, compost socks, silt stacks or comparable measure.
- Erosion control blanket used on steep slopes. Steep slopes are defined as areas with a slope ≥15% change in elevation.
- Stabilize all disturbed areas with temporary seeding, straw or wood mulch or permanent vegetation immediately after rough grading is completed if a delay in finished grade is expected.
- Protected excavated topsoil areas. Excavated topsoil shall have properly installed perimeter silt fencing or equivalent, and be protected from erosion by wind and rain using tarps, seeding, mulch, compost or other suitable measures.

The prepared plan must consist of a project map with the following elements:

- A location sketch of the project and nearby major roadways, streams and other identifiable landmarks within 200’ of the project boundary.
- A location sketch of major, onsite topographic features, streams, existing soil types and vegetation located on the project site. Existing and proposed topographic contours greater than 2’ shall be shown on the sketch.
- Location and extent of temporary and permanent erosion and sediment control measures including both vegetative and structural practices.

Erosion control measures and plan shall be maintained by the on-site contractor and adjusted as necessary throughout all construction phases.

**Confirmation**

- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**SP 3.3 Do not install invasive plant species**

**Criteria**

The builder must not install invasive plants on site as defined by the local agricultural extension office and/or landscape architect. EarthCraft will not permit the installation of species listed in category 1 or 2 of the GA Exotic Pest Plant Council list, or other state equivalent guideline.

**Additional Resources**

For a list of invasive species and associated categories see http://gaeppc.org/list.cfm.

For state-specific resources on invasive plants see http://www.invasivespeciesinfo.gov/unitedstates/state.shtml.

For resources specific to the Southeast see http://www.invasive.org/eastern/eppc/index.html.

**Confirmation**

- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the pre-drywall and final inspections.
SP 3.4 Design and implement tree protection plan

Criteria
A professional landscape architect or certified arborist must develop a tree preservation site plan prior to clearing, grading or construction that identifies existing trees with diameter at breast height (DBH) dimensions exceeding 3” and designates ≥20% of those trees to be protected during all construction activities.

Tree root zones (area extending in all directions from the trunk) must be protected with a physical barrier to minimize all disturbances including those from parked vehicles and construction material storage. Set fences firmly; if wood fences are used, they must be a minimum of 2x2 lumber. Do not place any soil from clearing, grading or construction activity on top of any root zone for trees designated on a site plan to be preserved. Trees that are marked to be preserved on a site plan and for which utilities must pass through the root zones must not have surface dug trenches. Dig tunnels through the root zone in order to minimize root damage.

The builder must review tree preservation plan with subcontractors and post plan on job site.

Figure 1: Tunnel to minimize root damage (left) as opposed to surface-dug trenches in root zone (right)

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

SP 3.5 Leave ≥25% of site undisturbed

Criteria
For lots 1 acre or less, 25% or greater of the entire lot must be protected from all grading, tree clearing and construction activities (e.g. no material staging).

OR

For lots 1 acre or less, 25% or greater of the land in the community must be protected from all grading, tree clearing and construction activities (e.g. no material staging).

OR

For lots 1 acre or greater, 75% or greater of the land in the community must be protected from all grading, tree clearing and construction activities (e.g. no material staging).
Site Planning • Site Preparation and Preservation Measures

### Confirmation

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

### SP 3.6 Mill cleared logs

**Criteria**

Commercially process 100% of logs that meet sawmill standards into lumber, pulp or other use.

**Clarifications**

Logs cannot be buried in a landfill or chipped.

**Confirmation**

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

### SP 3.7 Grind stumps and limbs for mulch

**Criteria**

Grind 80% or greater of all tree stumps and limbs for mulch to be used on site or in a neighboring development. Mulched material cannot be buried in a landfill or burned.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
SP 3.8 Remove 100% of invasive plants from 100% of the site

Criteria
The builder must remove 100% of invasive plant growth from 100% of the site. Invasive plants are specified based on their probability to cause economic or environmental harm, or harm to human health.

Additional Resources
For state-specific resources on invasive plants see http://www.invasivespeciesinfo.gov/unitedstates/state.shtml.
For resources specific to the Southeast see http://www.invasive.org/eastern/eppc/index.html.

**Confirmation**
- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the pre-drywall and final inspections.

SP 3.9 Tree planting (36” caliper of trees per acre; trees ≥2” diameter)

Criteria
Plant a minimum of 36” total caliper of trees per acre. Trees counted towards the 36” caliper total must be ≥2” in diameter at breast height (DBH).

Example
If the house is built on a 1/2 acre lot, plant three 4” DBH trees and two 3” DBH trees for a total of 18” caliper of trees.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

SP 3.10 Certified wildlife habitat (development or lot)

Criteria
The site must have a wildlife habitat area that is approved by the National Wildlife Federation. Wildlife habitats can be established by planting native plants or leaving tracts of land undisturbed and protected. Habitats can be lot specific, or cover a larger area on the development as a whole.

Additional Resources
Information on creating such a habitat can be obtained from the National Wildlife Federation at https://secure.nwf.org/gardenforwildlife/certify.cfm?campaignid=WH09ASLP.

Local wildlife programs may be submitted to EarthCraft for approval as an alternate path to the National Wildlife Federation program.

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
SP 3.11 Home built within EarthCraft Community

Criteria
Build home in an EarthCraft Community.

Clarifications
Community must either be actively pursuing EarthCraft Communities certification or be a certified EarthCraft Community.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance of criteria with the builder at the final inspection.
Construction Waste Management

Each year, more than 130 million tons of debris from construction sites is sent to landfills in the United States, which accounts for one quarter of the non-industrial waste in the United States. However, the majority of construction debris is recyclable. By taking simple steps to recycle construction waste, a builder will reduce the amount of waste incinerated or placed in landfills, preventing pollution, and conserving and protecting our natural resources for future generations.

The Construction Waste Management category of EarthCraft House focuses on ways an EarthCraft Builder can reduce the amount of recyclable construction waste sent to landfills and reduce the need to extract virgin raw materials. The waste management strategies include grinding and repurposing wood scraps and gypsum, crushing concrete to use as aggregate and recycling metals.

Construction Waste

CW 1.0 No construction materials burned or buried on site

Criteria
No construction materials burned or buried on job site.

Confirmation
• The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the pre-drywall and final inspections.

CW 1.1 Proper cleaning and disposal of paint supplies

Criteria
Clean paint brushes, buckets, rollers and other paint supplies in sinks connected to house sewage system. Cleaning of paint supplies on grass or other areas leading to stormwater system is not allowed.

Dispose of paint supplies following local government rules and regulations. No dumping of paint is allowed.

Confirmation
• The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the pre-drywall and final inspections.

CW 1.2 Infill or previously developed lot building deconstruction with ≥25% material reuse on site

Criteria
At least 25% of the material from a home or building that has been deconstructed on the project site is reused in the current construction project seeking EarthCraft certification.

Clarification
The calculation of material percentage shall be based on the weight of the materials. If it is not practical to weigh the materials, approximate weights may be used. For example, if the foundation will be reused, an approximate weight per cubic foot may be determined to calculate the total weight of the foundation assembly.
CW 1.3 Post waste management plan and divert ≥75% from landfill

Criteria
Post a construction waste management plan on site, educate each subcontractor on the aspects of the plan that pertains to their work and enforce these measures. Waste management plan must either provide for onsite separation of materials to be recycled or provide for separation of recyclable materials by clean-up or waste hauling firms. Maintain documentation on diversion rate for each material.

1. Wood
Avoid disposal of a minimum of 75% by weight or volume) of solid sawn wood by recycling through a state or county approved program or by on-site grinding and application of wood chips as mulch. Pressure treated wood is exempt from this requirement and may not be milled or applied as mulch.

2. Cardboard
Avoid disposal of a minimum of 75% (by weight or volume) of cardboard generated from construction, including all material packaging.

3. Metal
Avoid disposal of a minimum of 75% (by weight or volume) of metal generated from construction, including contractor beverage cans.

4. Drywall (recycle or grind and spread on site)
Avoid disposal of a minimum of 75% (by weight or volume) of drywall generated from construction through an approved recycling program, or by onsite grinding and application of drywall as a soil amendment.

5. Plastics
Avoid disposal of a minimum of 75% (by weight or volume) of plastic generated from construction.

Additional Resources
For the NAHB Research Center’s “Builder’s Field Guide to Residential Construction Waste Management” publication see www.nahbrc.org.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
Resource Efficiency

Forests provide habitats to diverse animal species, offer watershed protection, prevent soil erosion and help maintain the water cycle. EarthCraft House encourages the protection of forests through resource efficient design. By taking the time to design a home to use less wood and by practicing simple measures to ensure that wood on site is used properly, a new home can reduce its impact the environment as well as cost less money to build.

EarthCraft projects can meet the requirements of the Resource Efficiency category through methods such as designing homes with 2’ dimensions, employing advanced framing techniques and providing clear framing plans and cut lists to contractors. These methods not only reduce the amount of lumber used on site, but also save money through reduced material costs, reduced tipping fees and increased customer satisfaction including improving the home’s energy efficiency.

Building materials come from a variety of sources, not all of which are environmentally friendly. The EarthCraft program strives to reduce the impact homes have on the environment, including the impacts that result from the extraction and manufacture of materials used in home construction. By choosing certain building materials, an EarthCraft Builder can conserve natural resources, prevent unnecessary waste and reduce pollution associated with manufacturing and transporting of materials.

Resource Efficient Design

RE 1.0 Minimum stud spacing: 16” centers for 2x4 and 2x6 walls

Criteria
Minimum stud spacing at 16” centers for 2x4 and 2x6 walls, unless construction documents specify that alternate spacing is structurally required. No more than 5% of studs may lack a structural purpose.

Clarifications
The builder must present construction documents demonstrating structural requirements for excess framing greater than 5%.

Example
Assuming 16” stud spacing, no more than one vertical stud (lacking a structural purpose) for every 30 linear feet of wall would be permitted.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

RE 1.1 Advanced Framing

Criteria

1. 2-stud corners at all locations
Use advanced framing techniques to frame the intersecting corner of two walls to reduce framing and provide continuous insulation (corners with more than two studs are not permitted).
2. **Ladder T-walls at all locations**

Construct exterior/interior wall intersections to reduce framing members and provide continuous insulation.

**Clarifications**
Consult local building codes in areas susceptible to high wind or seismic regions.

If installing a ladder T-wall, begin first ladder 2’ above the subfloor to aid in the installation of drywall.
RE 1.2 Site framing plan with precut framing package

Criteria
Review complete framing plan and framing package with framing contractor to reduce unnecessary framing. The framing plan must illustrate the location and size of every stud, cripple, plate, header and other framing members in the roof, walls and floors. The precut framing package must correspond directly with framing plan.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

RE 1.3 Floor joist centers (all floors)

Criteria
A. Floor joist centers at 24” (≥80%)
Space 80% or greater of all floor joists at 24” on center to minimize material waste.

B. Floor joist centers at 19.2” (≥80%)
Space 80% or greater of all floor joists at 19.2” on center to minimize material waste.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

RE 1.4 Wall spacing at 24” centers for non-load bearing 2x4 walls

Criteria
Space all non-load bearing wall studs at 24” on center.

Clarifications
The builder must present construction documents demonstrating structural requirements for excess framing greater than 5%.

Example
Assuming 24” stud spacing, no more than one vertical stud (lacking a structural purpose) for every 30 linear feet of wall would be permitted.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
RE 1.5 Exterior wall spacing at 24” centers for 2x6 walls with stacked framing

Criteria
Space all exterior wall studs at 24” on center using 2x6 lumber. Rafters and joists must align with stud spacing within a tolerance of 1” (stacked framing).

Clarifications
The builder must present construction documents demonstrating structural requirements for excess framing greater than 5%.

Example
Assuming 24” stud spacing, no more than one vertical stud (lacking a structural purpose) for every 30 linear feet of wall would be permitted.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

RE 1.6 Size headers for loads (non-structural headers in non-load bearing walls)

Criteria
Design and install appropriately sized headers in all walls. Eliminate load bearing headers in all non-load bearing walls and do not size all headers in load bearing walls to accommodate the greatest load case.

Clarifications
Consult local building codes in areas susceptible to high wind or seismic regions.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

RE 1.7 Ground Floor Accessibility

Criteria
Design and construct project to ensure accessibility to individuals of all ages and abilities. Provide the following design features on the ground (or entry) level of the home:

- A safe and continuous path of travel from the street entrance and/or parking area to a dwelling entrance that is level
- Internal doors and corridors that facilitate comfortable and unimpeded movement between spaces (minimum of 36” doorways and 36” hallways)
- A bathroom that provides easy access and contains:
  1. A step-free shower recess
  2. Reinforced walls around the toilet, shower and bath to support the safe installation of grab bars
  3. 5’ turning radius
- 5’ turning radius in kitchen
- A bedroom that once reasonably furnished, will provide a 5’ turning radius
- Rocker light switches
- Lever door handles (or equivalent)
Advanced Framing Products

RE 2.0 Insulated concrete forms, precast autoclaved aerated concrete or precast insulated foundation walls

Criteria
Construct a minimum of 90% of foundation walls using either insulated concrete forms (ICF), precast autoclaved aerated concrete (AAC) or other precast insulated foundation. Install ICF walls according to manufacturer’s specification, to a minimum of R-17 insulation, and meet state termite protection guidelines for ground contact insulation. Install AAC walls according to manufacturer's specifications and meet the prescriptive requirements for basement or mass walls as applicable in the 2009 IECC.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

Figure 6: Insulated concrete form (ICF)
RE 2.1 Engineered wall framing (≥90% of studs)

Criteria
Construct a minimum of 90% of total wall framing using non-solid sawn wood, such as laminated wood (e.g., laminated strand lumber) or finger-jointed studs.

Clarifications
Steel studs are not eligible for meeting this criteria. All non-solid sawn wood products must have no added urea-formaldehyde.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

RE 2.2 Deliver panelized construction or SIPs to the site pre-framed

Criteria

1. **Floors**
Construct a minimum of 90% of the floor area using a panelized floor system (e.g., structurally insulated panels) delivered to the jobsite pre-framed and precut. If installing structurally insulated panels (SIPs), a minimum of R-19 insulation must be used in Climate Zones 2, 3 and 4, demonstrating code compliance for trade-offs where appropriate. In all cases, install panelized floor according to manufacturer specifications.

2. **Exterior walls**
Construct a minimum of 90% of all exterior walls using panelized wall systems (e.g., structurally insulated panels) delivered to the jobsite pre-framed and precut. If installing structurally insulated panels (SIPs), a minimum of R-13 insulation must be used. In all cases, install panelized walls according to manufacturer specifications.

3. **Roof**
Construct a minimum of 90% of the roof area using a panelized roof system (e.g., structurally insulated panels) delivered to the jobsite pre-framed and precut. If installing structurally insulated panels (SIPs), a minimum of R-19 insulation must be used in Climate Zones 2, 3 and 4, demonstrating code compliance for trade-offs where appropriate. In all cases, install panelized roof according to manufacturer specifications.

Clarifications
Thermal mass and infiltration effects may not be included in R-value.

Floor area must equal conditioned floor area used for the confirmed HERS energy model.

**Figure 7: Structural insulated panel (SIP)**
Resource Efficiency • Local, Recycled and/or Natural Content Materials

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

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**Local, Recycled and/or Natural Content Materials**

**RE 3.0 Replace ≥25% of cement in concrete with fly ash or slag**

**Criteria**
Replace ≥25% of the cement with fly ash or slag in all concrete used for footings, foundation and basement walls and slabs.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**RE 3.1 Use building materials extracted, processed and manufactured ≤500 miles of site (3 points per product max 12)**

**Criteria**
Use building materials that 90% by weight or volume have been extracted, processed and manufactured within 500 miles of the site.

Each product meeting the criteria earns 3 points; no more than four products may receive credit for these points.

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**RE 3.2 Insulation (≥25% recycled content material)**

**Criteria**
Install 100% of insulation with ≥25% recycled material (pre or post-consumer) content by weight or volume in all walls, floors and ceilings.

**Additional Resources**
For more information about SCS-certified recycled content insulation see www.scscertified.com.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
RE 3.3 Engineered and no-added urea formaldehyde trim

Criteria

1. Interior (≥80%)
   Install a minimum of 80% of interior trim from non-solid sawn wood (e.g., finger-jointed wood, medium or high-density fiber board (MDF or HDF), etc.) or non-wood material, such as PVC. All non-solid sawn wood products must have no added urea-formaldehyde.

2. Exterior (including soffit, fascia and trim (≥75%))
   Install a minimum of 75% of exterior trim (e.g., soffit, fascia and trim) from non-solid sawn wood (e.g., finger-jointed wood, cementitious fiberboard (MDF or HDF), etc.) or non-wood material, such as PVC. All non-solid sawn wood products must have no added urea-formaldehyde.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

RE 3.4 Outdoor decking and porches (≥40% recycled content material on ≥90% area)

Criteria

Construct 90% of all outdoor decks and porches using 40% recycled content material.

Additional Resources

For more information about SCS-certified recycled content products see www.scscertified.com.

Confirmation

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
Durability and Moisture Management

An important aspect of building a sustainable home is ensuring durability throughout its life cycle. EarthCraft House recognizes that proper design and installation are integral to building a durable home with minimal moisture management issues. Reducing the life cycle costs due to maintenance, repair and replacement decreases the impact that home construction, and reconstruction, has on the environment. The durability and moisture management section includes items that improve long-term durability, occupant health and comfort.

Products and Applications

DU 1.0 All roof valleys direct water away from walls, dormers, chimneys, etc.

Criteria
Roof must be designed and built so that all roof valleys direct water flow away from walls, dormers, chimneys and vertical surfaces of any kind.

Confirmation
• The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

DU 1.1 Install drainage plane per manufacturer’s specifications

Criteria
A drainage plane must be installed and sealed as instructed by the manufacturer on the entire building assembly exposed to the exterior.

Figure 8: Example of manufacturer’s specifications for drainage plane installation
**Confirmation**
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

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**DU 1.2 Integrate drainage plane with**

**Criteria**

1. **Window and door pan flashing at sills and side flashing**
   Install water resistant flashing at the base and sides of all window and exterior door rough openings to direct water leaks out of the wall assembly. Side flashing must extend over sill flashing. All flashing must be integrated with drainage plane.

2. **Window and door head/top flashing**
   Install water resistant flashing at the head of all windows and exterior doors. Flashing must extend a minimum of 6” above the top of the window or door, or per manufacturer’s specifications. This head/top flashing must extend over side flashing and be integrated with drainage plane.

3. **Exterior wall cladding**
   Install a continuous drainage plane behind all exterior wall cladding and integrate with exterior wall cladding.

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**Figure 9: Steps 1&2: Preparing house wrap or builder paper**
(Graphic courtesy of US EPA Indoor airPLUS)
CREATE BACK-DAM OR SLOPE TO DIRECT ANY WATER THAT DRAINS TO THE SILL AREA OUTWARD AND ONTO THE DRAINAGE PLANE (HOUSEWRAP)

Figure 10: Step 3: Create back dam or slope away from interior
(Graphic courtesy of US EPA Indoor airPLUS)

SELF-ADHESIVE MEMBRANE APPLIED TO SILL AREA, CREATING 'PAN FLASHING' WHICH LAPS OVER AND ADHERES TO DRAINAGE PLANE

Figure 11: Step 4: Pan flashing - Option 1
(Graphic courtesy of US EPA Indoor airPLUS)
Figure 12: Step 4: Install plan flashing - Option 2
(Graphic courtesy of US EPA Indoor airPLUS)

Joining Housewrap to Pan Flashing
A) Either attach to pan flashing with membrane tape
B) Or, place sill material under the folded housewrap and secure with tape

PAN FLASHING TUCKED UNDER HOUSEWRAP

Figure 13: Step 5: Finishing window installation
(Graphic courtesy of US EPA Indoor airPLUS)

Window placed in wall opening
A: Window installed, resting on pan flashing
B: Vertical ‘side-legs’ of membrane flashing tape seal over side flanges of window unit
C: Tape at top of window covers side-legs
D: Housewrap ‘flap’ lowered to cover top tape and secured with tape at corners

A: Front of pan flashing
B: Side flashing
C: Head flashing
D: ‘Flap’ of housewrap material
Clarifications
Provide lapping as needed over lintels above window headers for brick cladding, or additional bond-break drainage plane layer provided behind all stucco and non-structural masonry cladding wall assemblies. Include weep holes for masonry veneer and weep screed for stucco cladding systems, according to the manufacturer’s specifications.

Exemptions
Sheathing products with integrated drainage planes, such as OSB with built-in protective overlays and extruded polystyrene foam boards, are not required to have an additional drainage plane installed provided the product is installed per manufacturer’s specifications.

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 1.3 Double layer of either building paper or housewrap behind cementitious stucco, stone veneer or synthetic stone veneer on framed walls

Criteria
Install a double layer of either building paper or house-wrap behind stucco, stone veneer or synthetic stone veneer on framed walls in order to provide a drainage plane behind materials that absorb and retain moisture.

Clarifications
All unvented, exterior cladding in contact with the substrate must meet the criteria.

A single layer of building paper coupled with a single layer of housewrap meets the intent of the criteria.

For stucco cladding systems, include weep screed per manufacturer’s specifications.

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 1.4 Roof gutters discharge water \(\geq 5'\) from foundation

Criteria
All rain from the roof must be collected in a roof gutter system and directed via downspouts such that water is discharged on a sloping finished grade \(\geq 5'\) away from the foundation.

Clarifications
When grading is not possible, water must be directed to an underground catchment system (not connected to the foundation drain system) that deposits water a minimum of 10’ from the foundation.
Roofs without gutters may be acceptable if rainwater is appropriately deposited to a grade-level rock bed with waterproof liner and drain pipe that discharges water according to the requirements above.

Rainwater-harvesting systems may be used to meet this requirement if they are able to drain overflow to meet requirements above.

For multifamily projects, non-permanent extensions do not qualify.

**DU 1.5 Flashing**

**Criteria**

1. **Self-sealing bituminous membrane or equivalent at valleys and roof deck penetrations**

   Install a self-sealing bituminous membrane or equivalent at all valleys and roof decking penetrations for added durability.

   Install flashing on all roof penetrations and integrate with roof drainage plan.
Durability and Moisture Management • Products and Applications

Figure 15: Membrane protection of roof valley
(Graphic courtesy of US EPA Indoor airPLUS)

Figure 16: Metal coil stock flashing formed to valley
(Graphic courtesy of US EPA Indoor airPLUS)
2. **Step and kick-out flashing at wall/roof and wall/porch intersections, flashing ≥4” on wall surface and integrated with wall and roof/deck/porch drainage planes**

Install step and kick-out flashing at all wall/roof and wall/porch intersections. Extend flashing ≥4” on the wall surface above the roof deck and integrate flashing with wall and roof drainage plans.

![Figure 17: Step 1: Kick-out flashing beginning run of step flashing (Graphic courtesy of US EPA Indoor airPLUS)](image)

![Figure 18: Step 2: Successive sections of step flashing integrated with courses of shingles (Graphic courtesy of US EPA Indoor airPLUS)](image)
Clarifications
For metal and rubber membrane roofs, install continuous flashing in place of step flashing.

For porches, install L-shaped flashing to the top of the ledger board and integrate with drainage plane (vertical leg of the flashing must extend along the wall above the ledger and the horizontal leg extends over the top of the ledger).

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 1.6 Maintain 2” clearance between wall siding and roof surface

Criteria
Terminate wall siding a minimum of a 2” above roof surface unless otherwise directed by product manufacturer installation specifications.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
### DU 1.7 If installed, crawlspace must be closed (not required if project is located in 100 year flood plain)

#### Criteria
If installed, crawlspace must be closed. No vents are allowed. Crawlspace must be conditioned.

Additional strategies required to meet this credit intent include but are not limited to:

- DU 2.6 100% coverage of ≥6 mil vapor barrier in crawlspace or beneath slab
- INN DU 1.7 Capillary break between footing and foundation
- IAQ 1.1 Sealed-combustion furnace and/or water heater or isolate furnace/water heater from conditioned space
- BE 1.5 Seal penetrations through
- BE 1.9 Install weather stripping

![Enclosed crawlspace with insulation along walls](image)

**Figure 20:** Enclosed crawlspace with insulation along walls

#### Clarifications
Projects built on 100-year flood plains are not eligible to earn this credit.

Drainage, pests and combustion safety issues are important considerations when sealing a crawlspace.

#### Example
Conditioning may involve one of the following methods:

- Continuously operated mechanical exhaust ventilation at a rate of 1 cfm for each 50 sq ft of crawlspace floor area including a make-up air pathway to the main living area such as a transfer grill.
- Conditioned air supply (e.g. via supply duct) sized to deliver a rate of 1 cfm for each 50 sq ft of crawlspace area.
- DU 2.17-B Additional dehumidification system: Basement or sealed crawlspace system.
Additional Resources
For more information about sealed crawlspaces, visit www.crawlspaces.org.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance with the builder at the pre-drywall and final inspections.

DU 1.8 Alternative termite treatment with no soil pretreatment

Criteria
Install one of the following alternative termite treatment system with no soil pretreatment.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

1. Non-toxic pest treatment of all lumber in contact with foundation (≥ above foundation)
   Pre-treat all lumber in contact with the foundation with a non-toxic pest treatment such as borate. Lumber must be treated to a minimum height of 3’ above the foundation.

2. Continuous foundation termite flashing
   Install a continuous termite shield that covers 100% of the foundation stem wall, piers and other potential entry points. The termite shield can be fabricated from metal or similar material that forms a physical barrier to termites. All seams and penetrations in the termite shield must be effectively sealed to prevent termite entry.

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 1.9 Vented rain screen behind exterior cladding

Criteria
All exterior wall area must have a weather resistive barrier such as building paper, house-wrap or similar material designed to protect the wall from water moving past the exterior cladding, and have an air space of at least 3/8” between the exterior cladding and weather resistive barrier. The system must be integrated with flashing and be designed and installed to minimize moisture migration between the exterior cladding and the wall sheathing.
Clarifications
If installing masonry veneer, install full-head weep holes with a minimum 24” on center spacing.

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 1.10 Roofing warranty ≥ 40 - year

Criteria
Install shingles or other exterior roofing material that have ≥40 year manufacturer’s warranty.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
DU 1.11 Outdoor deck material (≥25-year warranty)

Criteria
All outdoor decking and deck material must have ≥25-year warranty.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

DU 1.12 Install plants to maintain ≥2’ distance from home at maturity

Criteria
Locate all bushes, shrubs, trees, vines and other vegetation so that at maturity the plantings are ≥2’ of the building exterior.

Clarifications
In order to meet the 2’ spacing requirement at maturity, most plants will need to be greater than 2’ from the home at the time of the final inspection.

Measurement is from the closest edge of the plant foliage to the home, not the center or stem of the plant.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

Moisture Control

DU 2.0 Gravel bed beneath sub-grade slabs

Criteria
Install a ≥4” deep gravel bed (consisting of ≥0.5” clean aggregate) beneath all sub-grade concrete floor slabs.

OR

Install a ≥4” of uniform layer of sand with geotextile drainage matting.

Clarifications
Gravel bed must be installed beneath vapor barrier.

Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

DU 2.1 100% coverage of ≥6 mil vapor barrier beneath all slabs

Criteria
Install a vapor barrier ≥6mil beneath all slabs to prevent soil moisture and gases from entering the home. Provide 100% coverage. Overlap all vapor barrier joints a minimum of 6”.

DU 2.2 Damp proofing of below-grade walls

Criteria
Apply damp proofing for all below-grade walls.

Clarifications
Wood-framed below-grade walls are not allowed along the exterior of the home.

Do not install Class 1 vapor retarders on the interior side of air permeable insulation in exterior below-grade walls, except for tile at showers and tub walls. Mirrors may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

Additional strategies required to meet this credit intent include but are not limited to:

- BE 1.0 Install vapor barriers only under slabs and on crawlspace floors

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

DU 2.3 Foundation drain on top of sub-grade footing

Criteria
Install a protected foundation drain tile on top of the footing. Use appropriate drain elbows for bends to prevent drainage constriction around corners. Surround each pipe with $\geq 6''$ of 1/2”- 3/4” gravel and wrap gravel layer fully with fabric cloth. Discharge all drain lines either away and downhill from the foundation to outside grade/daylight, drywell or to a sump pump.

Figure 22: Foundation drain on top of footing
Clarifications
Installing the foundation drain at the outside perimeter edge of sub-grading footing and meeting the criteria of DU 2.9 meets this requirement.

**Confirmation**
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

**DU 2.4 Patio slabs, walks and driveways sloped ≥1/4” per 1’ away from home for ≥10’ or to the edge of the surface, whichever is less**

**Criteria**
Slope patio slabs, porch slabs, walks and driveways a minimum of 1/4” per 1’ away from house over a minimum distance of 10’, or to the end of the slabs, walks and driveways. Tamp back-fill to prevent settling under patio slabs, walks and driveways unless proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist or engineer.

**Clarifications**
Where setbacks limit space to less than 10’, install swales or drains designed to carry water away from the foundation.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**DU 2.5 Final site grade sloped ≥1/2” per 1’ away from home for ≥10’ or to the edge of the site, whichever is less**

**Criteria**
Slope final site grade away from the foundation at a rate of 1/2” per 1’ over a minimum distance of 10 feet. Tamp back-fill to prevent settling unless proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer.

**Clarifications**
Where setbacks limit space to less than 10 feet, install swales or drains designed to carry water away from the foundation.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**DU 2.6 100% coverage of ≥6 mil vapor barrier in crawlspace**

**Criteria**
Install continuous Class 1 vapor barrier (≥6 mil) over all exposed earth in crawlspaces. Provide 100% coverage. Overlap all vapor barrier joints a minimum of 6” and seal joints using appropriate sealant. Extend and seal edges of vapor barrier at least 6” up the foundation wall, piers and above exterior ground grade level.
**DU 2.7 Do not install wet or water-damaged building materials**

**Criteria**
Do not install building materials that have visible signs of water damage or mold.

**Clarifications**
If the framing members or the insulation has high moisture content (framing members shall be dried to at least 18% moisture content), do not enclose interior walls. Follow the manufacturer's drying recommendations for wet-applied insulation and test framing members for moisture prior to enclosing wall cavities.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

*If high moisture was present*
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**DU 2.8 Rigid, moisture-resistant backing material behind tubs and showers**

**Criteria**
Install cement board, fiberglass enhanced sheathing or equivalent moisture-resistant backing material on walls behind tubs and showers with tile or panel assemblies with caulked joints. Install moisture-resistant backing material in accordance with manufacturer specifications.

**Clarifications**
Do not use paper-faced backerboard.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**DU 2.9 No wall-to-wall carpet within 3’ of toilets, tubs and showers**

**Criteria**
Do not install wall-to-wall carpet or other soft floor coverings within 3’ of toilets, tubs and showers.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
**Durability and Moisture Management**

**Moisture Control**

**DU 2.10 Foundation drain at outside perimeter edge of footing surrounded with 6” clean gravel and fabric filter**

Criteria

Install a protected foundation drain tile so that the top of the drain tile pipe is below the bottom of the concrete slab or crawlspace floor, or alongside the outside perimeter edge of the footing, whichever is lower. Use appropriate drain elbows for bends to prevent drainage constriction around corners, or use an EarthCraft approved product that meets the same intent. Surround each pipe with at least 6” of 1/2” to 3/4” gravel. Wrap gravel layer fully with fabric cloth. Discharge all drain lines either away and downhill from the foundation to outside grade/daylight or to a sump pump.

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**Clarifications**

- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

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**Figure 23: Foundation drain next to footing**

**Figure 24: Foundation drain next to footing**
DU 2.11 Drain or sump pump in basement/crawlspace with sealed cover

Criteria
Install a drain or sump in basement or crawlspace floors. Drain or sump pump must discharge either at least 10’ away to daylight from foundation, into a sewer system or into another site approved drainage system such as a drywell.

Clarifications
Drains or sump pumps are not required for slab-on-grade foundations.

If sump pump is installed, cover must be mechanically attached with full gasket seal.

A sump pump can also be incorporated into a radon mitigation system.

Additional Resources
For more information see EPA’s guide to “Building Radon Out” at www.southface.org/radon.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

DU 2.12 Install supplemental dehumidification

Criteria
Install a whole-house ENERGY STAR dehumidifier.

Clarifications
A stand-alone dehumidifier located near a central return with drain line connected to the HVAC condensate pump may qualify to meet the criteria. Plan shall be approved by EarthCraft Technical Advisor prior to installation to ensure intent is met.

As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

Additional Resources
A list of qualified products can be found at:  http://www.energystar.gov

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

DU 2.13 Gravel bed beneath on-grade or raised slab

Criteria
Install a $\geq 4''$ deep gravel bed (consisting of $\geq 0.5''$ clean aggregate beneath on-grade or raised concrete floor slabs.

Clarifications
Gravel bed must be installed beneath vapor barrier.

If gravel is not available, install a $\geq 4''$ of uniform layer of sand with geotextile drainage matting.
Durability and Moisture Management • Moisture Control

DU 2.14 Slab or crawlspace vapor barrier ≥10 mil or reinforced

Criteria
Install either a ≥10 mil polyethylene vapor barrier or a ≥6 mil reinforced polyethylene vapor barrier over all exposed earth (above grade) in crawlspaces and below slabs. Overlap sheeting 6”-12” at the seams and seal at seams and to walls with mastic or other appropriate sealant. Provide 100% coverage. Wrap plastic up the walls to be above grade of exterior soil or 2’, whichever is greater.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

DU 2.15 Wall cavity insulation without a vapor retarder or kraft paper

Criteria
Install wall cavity insulation without a vapor retarder or kraft paper.

Clarifications
Products with a perm rating greater than 1.0 are acceptable.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
Indoor Air Quality

Because the average American spends over 90% of their time indoors, creating a healthy and comfortable indoor environment is an important issue for any resident especially those who are more sensitive to air quality such as children, seniors, and individuals with respiratory problems and compromised immune systems. EarthCraft Builders can improve the health of a home by installing materials with fewer pollutants, flushing any pollutants out through proper ventilation and controlling moisture to eliminate mold growth.

The Indoor Air Quality category consists of items that aim to reduce the presence of pollutants and contaminant in the air inside a building. Reducing or eliminating the presence of manmade pollutants such as volatile organic compounds or natural occurring carcinogens such as radon leads to a healthier environment for occupants.

Combustion Safety

IAQ 1.0 No unvented combustion fireplaces, appliances or space heaters

Criteria
Do not install unvented combustion space-heating appliances.

Clarifications
Vent all combustion fireplaces and appliances to remove combustion products as well as process fumes to the outside air.

 Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

IAQ 1.1 Sealed-combustion furnace and/or water heater or isolate furnace/water heater from conditioned space

Criteria
Install only sealed combustion (direct vented) furnaces/boilers/water heaters, or install furnaces/boilers/water heaters in an isolated combustion closet if located within conditioned space.

 Furnaces/boilers:
Install furnaces/boilers in isolated combustion closets if located within conditioned space.

 OR

 Install furnace/boilers that have sealed combustion and direct venting if located within conditioned space.

 OR

 Install furnace/boilers outside the building envelope.

 OR

 Install furnace/boilers utilizing a combination of the strategies outlines above.
**Water heaters:**
Install gas water heater in an isolated combustion closet if located within conditioned space.

OR

Install gas water heater that has sealed combustion and direct venting or power venting if located within conditioned space.

OR

Install electric water heater.

OR

Install water heater outside the building envelope.

**Clarifications**
If installing furnace/boiler in an isolated combustion closet:

- Seal between the bottom plate and subfloor
- Insulate walls, floors and ceilings separating the combustion closet from conditioned space
- Seal sheathing covering the interior and exterior walls and ceilings separating the combustion closet from conditioned space
- Install a solid (non-louvered) exterior grade access door with weather stripping and threshold
- Provide combustion air from outside the house in compliance with the mechanical code

Figure 25: Furnace isolated from conditioned space
If installing gas water heater in an isolated combustion closet:

- Seal between the bottom plate and subfloor
- Insulate walls, floors and ceilings separating the combustion closet from conditioned space
- Seal sheathing covering the interior and exterior walls and ceilings separating the combustion closet from conditioned space
- Install a solid (non-louvered) exterior grade access door with weather stripping and threshold
- Provide combustion air from outside the house in compliance with the mechanical code

If installing sealed combustion furnace/boiler/water heater, provide combustion air from outside the house in compliance with the mechanical code and manufacturer specifications.

Do not install atmospherically vented furnaces/boilers/water heaters in conditioned space.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

### IAQ 1.2 All fireplaces have outdoor combustion air supply and flue damper

**Criteria**

All fireplaces must use a supply duct supplying outside air for combustion that complies with the fire code.

Masonry-built fireplaces must have gasketed glass doors.

**Clarifications**

Fireplaces that meet these guidelines include:

- Masonry heaters as defined by ASTM E1602 and section 2112.1 of the International Building Code (i.e., fireplaces engineered to store and release substantial portions of heat generated from a rapid burn).
- Factory-built, wood-burning fireplaces that meet the certification requirements of UL 127 and emission limits found in the EPA Standard for New Residential Wood Heaters.
- Wood stove and fireplace inserts as defined in section 3.8 of UL 1482 that meet the certification requirements of that standard, and meet the emission requirements of the EPA Standards for New Residential Wood Heaters and WAC 173-433-100 (3).
- Pellet stoves that meet the requirements of ASTM E1509.

**Confirmation**

- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.
IAQ 1.3 Carbon monoxide detector (one per floor, hard wired with battery back-up)

Criteria
Install one carbon monoxide (CO) detector per floor, even if home has no garage or combustion appliances. If bedrooms are on the floor, install the CO detector in a central location near all bedrooms. All carbon monoxide (CO) detectors must be hard-wired with battery back-up. CO detectors must be certified by CSA 6.19-01 or UL 2034.

Clarification
Combination smoke/CO detectors meet the intent provided they are certified by CSA 6.19-01 or UL 2034.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

IAQ 1.4 Garage ventilation

Criteria

A. Control attached garage exhaust fan by motion sensor or timer
Install an exhaust fan in an attached garage that operates continuously or operates whenever the garage is occupied and for at least 1 hour after the garage has been vacated.

B. Detached garage or no garage
Isolate the garage by a minimum of 4’ from the exterior walls or exterior floor of any conditioned area of the house.

OR

Design and construct home with an open-carport or no garage.

Clarifications
If operating continuously, install a fan that is rated at a minimum of 75 cfm.

If operating whenever the garage is occupied and for at least 1 hour after the garage has been vacated, install fan that is rated at a minimum of 100 cfm of airflow and is controlled by a timer or motion sensor.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

IAQ 1.5 Sealed combustion, direct-vent fireplace(s) or no fireplace

Criteria
All installed fireplaces must meet indoor air quality guidelines below and sealed combustion, direct-ventilation with permanent glass cover.

OR

Do not install a fireplace.
Clarifications
Fireplaces that meet these guidelines include:

- Gas or propane powered, sealed combustion and direct or power vented as rated by the American Gas Association (AGA) with a permanently affixed glass front.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

Indoor Pollutant Control

IAQ 2.0 Protect all ducts until floor finishing is complete

Criteria
All ducts (including those in floors, walls and ceilings) must be protected to prevent construction debris from entering ductwork. The systems shall either not be run until finished floor installed and/or pleated filters shall be required upon early startup with a filter change halfway between startup and CO.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

IAQ 2.1 Pleated filter installed during construction

Criteria
All HVAC systems operating during construction must have pleated filter installed prior to start-up to collect construction debris.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance at pre-drywall and inspections.

IAQ 2.2 All outdoor supply air crosses filter prior to distribution

Criteria
Design and install outdoor air supply ventilation so that all outdoor air crosses a filter prior to distribution.

Confirmation
- The builder must submit documentation demonstrating compliance to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder at the pre-drywall inspection
- The EarthCraft Technical Advisor will visually confirm compliance at final inspection.
### IAQ 2.3 Filter easily accessible for occupant

**Criteria**
Install all filters in an easily accessible location. Easily accessible is defined as any location which facilitates access and regular filter changes by future occupant.

**Clarifications**
Filters located in attics are considered easily accessible if drop-down stairs provide access to attic and a permanently installed walkway has been provided between the attic access location and the filters. Filters located within the home (e.g., at the return grill) are also considered easily accessible. Filters located within crawlspaces are considered easily accessible if within 5’ of the entrance or in crawls with a height of 4’ or greater at walk area between entrance and filter.

Filter door shall not be obstructed by any permanent fixtures including condensate line or refrigerant line set.

**Confirmation**
- The builder must submit documentation demonstrating compliance to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder at the pre-drywall inspection.
- The EarthCraft Technical Advisor will visually confirm compliance at final inspection.

### IAQ 2.4 No HVAC ducts or equipment in garage and no conditioned air supplied to garage

**Criteria**
Do not install air-handling equipment in the garage or install supply or return vents to provide conditioned air to garage.

**Clarifications**
Ducts and air-handling equipment may be installed in the framing spaces or building cavities adjacent to garage if they are separated from the garage space with a continuous air barrier and the space is large enough to accommodate the duct diameter.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

### IAQ 2.5 Indoor airPLUS Certification

**Criteria**
Construct and certify home in accordance with Indoor airPLUS guidelines. Complete Indoor airPLUS Verification Checklist and include a copy in the project-specific owner’s manual.
Additional Resources
See www.epa.gov/radon/zonemap.html

**Confirmation**
- The builder must submit documentation, including photo documentation, demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection and final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will verify compliance of criteria at the pre-drywall inspection and final inspection.

### IAQ 2.6 Filters

#### Criteria

1. \(\geq\) MERV 6  
   Install an HVAC filter with a MERV 6 or higher filtration (according to ASHRAE 52.2) on all HVAC systems. HVAC design and installation must account for airflow based on filter selection.

2. **Builder supplies homeowner with 12 months of \(\geq\) MERV 6**  
   Builder provides homeowner with 12 months of \(\geq\) MERV 6 filters for use on installed HVAC equipment.

3. **Access panel includes gasket and fits snugly.**  
   Eliminate filter bypass between the filter and filter rack by sealing the filter access panel to prevent air leakage and ensuring it fits snugly against the exposed edge of the installed filter when closed.

#### Clarifications

- Filters perform best when the filter rack design includes flexible, air tight (e.g., closed-cell foam) gasket material on the downstream side of the filter and friction fit or spring clips installed on the upstream side of the filter. Non-standard efficiency ratings for filters (e.g., 3M’s Microparticle Performance Rating (MPR)) and filters that do not have a MERV rating (e.g., electrostatic filters) need prior approval by EarthCraft.

- HVAC system design and installation must be designed to accommodate the criteria.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

### IAQ 2.7 Provide rodent and corrosion proof screens with mesh \(\leq 0.5"\) for all openings not fully sealed or caulked

#### Criteria

Install corrosion-proof rodent/bird screens (e.g., copper or stainless steel) with a mesh 0.5" or greater on all building openings, such as ventilation system intake/exhaust outlets and attic/crawl space vent openings that cannot be fully sealed or caulked.

#### Clarifications

- Clothes dryer vents shall use a flap damper to prevent rodent entry.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
IAQ 2.8 Radon resistant construction (Required if located in high radon zone)

Criteria

1. **Passive, labeled radon/soil gas system**
   Install a passive radon vent system in compliance with EPA's "Building Radon Out".

2. **Radon test of home prior to occupancy or provide test kits to buyer**
   Test home for radon prior to occupancy according to EPA testing procedures. Disclose test results to potential homebuyers.

   OR

Provide two radon test kits designed for 48-hour exposures to the homebuyer(s), including test kit instructions and EPA guidance on follow-up actions to be taken in response to the test results.

![Figure 26: Radon vent pipe](image)
Clarifications
Projects in all radon zones must comply.

Additional resources
EPA's "Building Radon Out" can be found online at:
www.epa.gov/radon/pdfs/buildradonout.pdf

IAQ 2.9 MERV 13 pleated filter ≥4” in thickness

Criteria
Install a MERV 13 or higher filtration (according to ASHRAE 52.2) on all HVAC systems. Filter must be ≥4” thick.

Clarifications
HVAC design and installation must account for airflow based on filter selection.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

IAQ 2.10 Protect ducts until construction is completed

Criteria
Upon installation of ductwork, seal all supply and return duct openings to stop construction trash and dust from contaminating new duct system, and keep ducts sealed for the duration of construction. Ducts must stay clean enough to pass a white glove test at final inspection for credit to be awarded. The systems shall either not be run until finished floor installed and/or pleated filters shall be required upon early startup with a filter change halfway between startup and CO.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

IAQ 2.11 Flush home before occupancy

Criteria
Flush home during and shortly after installing products that are known sources of contaminants (e.g., cabinets, carpet padding, painting) and for 48 hours prior to occupancy.

Example
To flush home either keep all windows open and run interior fans (e.g., HVAC system fans, exhaust fans and interior circulation fans) continuously, or close exterior windows and doors and run all HVAC fans, exhaust fans and interior circulation fans continuously at the highest rate. Keep all interior doors open, use additional fans to circulate air within home. Replace all filters after flushing home.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance of criteria with the builder at the final inspection.
IAQ 2.12 Certified low or no VOC materials meeting guidelines:

Criteria

1. **Interior paints**
   Use only interior paints that are certified as low or no VOC by one of the following:
   - Green Seal Standard GS-11
   - Greenguard Certification for Paints and Coatings
   - Indoor Advantage Gold Master Painters Institute (MPI) Green Performance Standards GPS-1 or GPS-2
   - a third-party low-emitting product list based on CA Section 01350

2. **Stains and finishes on wood floors**
   Use only finishes on wood floors that are certified as low or no VOC by one of the following: Green Seal Standard GS-11, Greenguard Certification for Paints and Coatings, Scientific Certification Systems (SCS) Standard EC-10.2-2007, Indoor Advantage Gold Master Painters Institute (MPI) Green Performance Standards GPS-1 or GPS-2, or a third-party low-emitting product list based on CA Section 01350.

3. ** Sealants and adhesives**
   Use only interior sealants and adhesives that have a VOC (Volatile Organic Compound) content of 250 g/L or less.

4. **Carpet**
   Install only carpet that qualifies as CRI Green Label Plus or has been tested and meets all the requirements of the CRI Green Label Plus testing program criteria.

   AND

   Install only carpet pad that qualifies as CRI Green Label Plus or has been tested to meet all the requirements of the CRI Green Label Plus testing program criteria.

   AND

   Install only carpet pad adhesives that qualify as CRI Green Label Plus or have been tested to meet all the requirements of the CRI Green Label Plus testing program criteria.

Additional Resources


Confirmation

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
IAQ 2.13 No wall-to-wall carpet in entire home

Criteria
Do not install wall-to-wall carpet in home.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

IAQ 2.14 Install permanent walk-off mats, or permanent shoe removal area and storage, at each entry

Criteria
Install a built-in walk-off mat at each entry to the home from the exterior.

OR

Install shoe removal area and storage space near each entry to the home from the exterior. The space may not have wall-to-wall carpeting, and it must be large enough to accommodate a sitting place (e.g. bench or chair) and at least two pairs of shoes per bedroom.

Clarifications
Walk off-mats must be at least 2’ in length and allow accessibility for cleaning (e.g., grating with catch basin).

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
High Performance Building Envelope

One of the key elements to any energy efficient home is constructing a proper building envelope by sealing for air leaks, properly installing insulation and using high-quality windows. The building envelope is the barrier that separates the home’s conditioned space from unconditioned space or the outside. The building envelope consists of two parts – an air barrier and a thermal barrier (insulation) that must be both continuous and contiguous (touching each other). In a typical residence, the building envelope consists of the roof or ceiling, walls, windows, doors, and floor or foundation. Buildings account for about 40% of all energy use in the United States. EarthCraft encourages an energy efficient building envelope to reduce this impact.

Energy Code and Energy Performance

BE 0.1 IECC adopted by jurisdiction plus applicable state amendments

Criteria
Home must meet the International Energy Conservation Code (IECC) adopted by the project’s jurisdiction plus any applicable state amendments.

Clarifications
Where local code is more stringent than EarthCraft criteria, local code criteria must be met.

Additional Resources

For more information on state-adopted energy codes, visit www.energycodes.gov.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 0.2 Confirmed HERS Rating Index ≤ ENERGY STAR HERS Index Target without SAF or follow ENERGY STAR prescriptive path

Criteria
Home energy model based on actual construction must demonstrate a confirmed HERS Rating Index that is less than or equal to the ENERGY STAR HERS Index Target without SAF.

OR

Home must meet and be qualified through the ENERGY STAR v3 prescriptive path.

Definitions
ENERGY STAR HERS Index Target: the HERS Index of ENERGY STAR Reference Design Home without SAF.

SAF: the Size Adjustment Factor

Additional Resources
More information on ENERGY STAR New Homes may be found at www.energystar.gov.
BE 0.3 ENERGY STAR V3 New Home Certification

Criteria
Construct and certify home in accordance with ENERGY STAR Qualified New Home specifications. Complete all necessary steps to qualify home under ENERGY STAR including all checklists and inspections.

Clarifications
Builder must be an active ENERGY STAR Partner and complete the online ENERGY STAR Orientation Training to be eligible to build homes qualified under version 3.

HVAC contractors must complete ENERGY STAR version 3 training and be credentialed through an EPA-recognized industry organization.

Additional Resources
For more information about ENERGY STAR see: www.energystar.gov.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection and final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will diagnostically test compliance of criteria at the pre-drywall inspection and final inspection.

BE 0.4 DOE Zero Energy Ready Home Challenge

Criteria
Construct and certify home according to the requirements in the DOE Zero Energy Ready Challenge Home.

Additional Resources
For more information, see http://www1.eere.energy.gov/buildings/challenge/.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

Air Sealing Measures

BE 1.0 Install vapor barriers only under slabs and on crawl space floors

Criteria
No polyethylene or other materials with a perm rating \( \leq 0.1 \), such as vinyl wall paper, may be used on foundation or above grade walls, or an in any other assembly except under slabs and on crawl space floors.
Clarifications
Tile is permitted on tub and shower walls and behind counters for backsplash protection.

Additional Resources
For perm ratings of materials, review manufacturer’s product specifications or 2005 ASHRAE Handbook of Fundamentals, Chapter 25, Tables 7A and 7B.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

BE 1.1 Seal bottom plates to subfloor or foundation

Criteria
Seal bottom plates of walls separating conditioned and unconditioned spaces to subfloor or foundation using appropriate sealant, including bottom plate to subfloor connections in garage.
Clarifications
Foam gasket alone does not meet the criteria.

Example
An acceptable strategy is a foam gasket beneath the bottom plate in combination with a suitable sealant.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

BE 1.2 Block and seal joist cavities

Criteria

1. **Above attached garage walls**
Block and seal all joist cavities above the attached garage wall using rigid blocking and appropriate sealant.

2. **Above supporting wall at cantilevered floors**
Block and seal all cantilevered floor joist cavities above the top plate of the supporting wall using rigid blocking and appropriate sealant.

   Seal exterior sheathing on bottom of cantilevered floor.

3. **Under attic kneewalls**
Block and seal all joist cavities below kneewall using rigid blocking and appropriate sealant.

Clarifications
Attic kneewalls, defined as a vertical or near vertical wall separating conditioned space from unconditioned attic space which also include skylight shaft walls or walls adjacent to porch roofs.
**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 1.3 Block stud cavities at change in ceiling height**

**Criteria**
Block stud cavities at locations of varying ceiling height, including common walls between adjacent rooms and dropped ceilings in hallways.
Clarifications
Changes in ceiling height 18” or greater are considered attic kneewalls.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 1.4 Install blocking and baffles in insulated and vented vaulted ceilings**

**Criteria**
Install blocking in rafter cavities above top plate of exterior wall if air-permeable insulation (e.g., fiberglass batts or cellulose insulation) is used and the roofing assembly must be ventilated. Blocking must be in contact with rafter baffle to allow proper roof deck ventilation and prevent wind-washing of insulation.
Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 1.5 Seal penetrations through**

**Criteria**

1. *Foundation and exterior wall assemblies*

Seal penetrations and joints in and between the foundation and exterior wall assemblies with blocking materials, foam and polyurethane caulk or the equivalent.

2. *Top and bottom plates*

Seal all holes in the top and bottom plates for plumbing, wiring, ductwork and other purposes connecting conditioned and unconditioned (including exterior) areas, using appropriate sealant materials.

3. *Band and rim joists*

Seal all penetrations through the band and rim joist (between conditioned and exterior spaces and conditioned and garage spaces) including holes drilled for HVAC lines, plumbing lines, bathroom fans, exhaust fans and electrical lines using appropriate sealant.
4. *Insulated subfloors*

Seal all penetrations (e.g. HVAC, plumbing and electrical) through insulated floor systems over unconditioned areas such as vented crawlspaces, unconditioned basements and garages.
5. **Sheathing**
Seal penetrations in exterior wall sheathing including condensation lines, electrical outlets, water spigots, utility boxes and locations with broken or missing sheathing using appropriate materials and sealant.

6. **Walls and ceilings in attached garages**
Seal penetrations such as light fixtures, switches, electric boxes and plumbing pipe penetrations through wall and ceiling drywall in attached garage using appropriate sealant.

7. **Insulated ceilings**
Seal penetrations (e.g., rough openings for can lights, ceiling fans and low voltage fixture penetrations) through insulated ceilings using appropriate sealant.

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![Figure 34: Air sealing at HVAC boot in insulated ceiling](image-url1)

![Figure 35: Air sealing at can light](image-url2)
Clarifications
Seal penetrations for flues and other heat-producing items with noncombustible sheet materials and high temperature sealant.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 1.6 Seal penetrations around

Criteria

1. Shower and tub drains
Block and seal subfloor penetrations for shower and tub drain using rigid sheeting and appropriate sealant. Plumbing penetrations in slab floors must be sealed with appropriate sealant.

2. HVAC supply and return boots sealed to subfloor or drywall (floors, walls and ceilings)
Seal all HVAC supply and return boots to subfloor or drywall using appropriate sealant.
3. **Window and door rough openings**

Seal the space between the framing for window and door rough openings and the installed units using non-expanding or low-expanding spray foam sealant or closed-cell foam backer rod with appropriate sealant. Seal thresholds for exterior doors to the subfloor or slab.

**Figure 37: Sealing boot to subfloor**

**Figure 38: Air sealing around window and door rough openings**
4. **All drywall penetrations in common walls between attached homes**
For all common walls between two dwelling units (e.g., duplexes, townhomes and multifamily), seal all penetrations through the top and bottom plate, and all drywall penetrations where permissible by fire code.

5. **Exhaust fans to drywall**
Seal all bathroom and kitchen exhaust fan housing units to drywall using appropriate sealant.

6. **Attic pull-down stairs, scuttle holes and kneewall doors**
Seal the space between the framing and attic pull-down stairs, scuttle holes or kneewall doors using non or low-expanding spray foam sealant or closed-cell foam backer rod with appropriate sealant.

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![Figure 39: Attic pull-down stairs with foam board](image)

![Figure 40: Attic pull-down stairs with batt insulation](image)
7. **Chases**

Seal and insulate framed spaces that connect conditioned areas to unconditioned areas above and below the chase (including attics, unconditioned basements or vented crawl spaces) using sheet material and appropriate sealant. These areas include chases for plumbing, duct work, chimneys and flues.

![Figure 41: Rigid air barrier at chase on insulated wall](image)

**Clarifications**

Cellulose, fiberglass or rockwool batt insulation is not acceptable as a sealant.

For chases with high temperature heat sources, use noncombustible sheet materials such as sheet metal and high temperature caulk to seal chase.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

**BE 1.7 Seal seams and gaps in**

**Criteria**

1. **Band joist sheathing**

Seal all seams in band joist sheathing separating conditioned and unconditioned spaces between conditioned floors. Band joist shall be sealed to top plate, subfloor and at butt joints, or at exterior sheathing.
2. *Exterior wall sheathing*
Seal all gaps $\geq \frac{1}{8}$" in exterior sheathing, such as seams between adjacent sheets, using appropriate sealant.

3. *All seams in SIPs*
Seal all seams between structurally insulated panels (SIPs) with appropriate sealant on the interior and exterior of the building envelope.

4. *Marriage joints between modular home modules*
Seal marriage joints between modular home modules that connect conditioned space to the exterior with gasket, sealant and tape per manufacturer specifications.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 1.8 Install rigid air barriers**

**Criteria**

1. *Behind tubs and showers on insulated walls*
Install rigid interior air barrier behind tubs and showers on insulated walls before installing tub and shower assemblies.
2. **At attic kneewall on attic-side (including skylight shafts)**
   Install attic-side rigid air barrier to all kneewalls including skylight shafts. Seal seams of air barrier using appropriate sealant. Block and seal top and bottom of kneewall/skylight shaft stud cavity to encapsulate insulation.

3. **At chases in contact with the building envelope (including fireplace chases)**
   All chases in contact with building envelope have air barrier applied to the interior of the chase where it meets the building envelope. All chase walls must be sealed using appropriate sealant (i.e., compliant with applicable fire code and manufacturer specifications).

4. **Along staircases on insulated walls**
   Install rigid air barrier to the interior of all staircase walls adjoining unconditioned spaces (e.g., exterior walls, garages or unconditioned attics). Seal seams of air barrier and penetrations through air barrier using appropriate sealant. Air barrier shall include areas under enclosed landings and bottom stairs.

5. **Along porch roofs**
   Seal and insulate all porch roofs separating unconditioned and conditioned space if blocking, air sealing and insulation are not installed at the vertical connection between the conditioned interior of the home and the porch roof area.

6. **At dropped ceiling/soffit**
   Seal and insulate dropped ceilings/soffits between conditioned areas and the attic using sheet material and appropriate sealant.

**Clarifications**

If cavity will be inaccessible for insulation installation after sheathing is applied, install insulation prior to enclosing the cavity. All fireplace chase walls must be sealed using appropriate sealant (i.e., compliant with applicable fire code and manufacturer specifications).

For Climate Zones 2-3, homes with Grade II insulation installation or worse on fireplace chase walls, and all homes in Climate Zone 4, an internal air barrier must be installed on fireplace chase walls in addition to the exterior air barrier on fireplace chase walls.

Changes in ceiling height 18” or greater are considered attic kneewalls.
Exemptions

For Climate Zones 2-3, homes with Grade I insulation installation and proper insulation support on fireplace walls, or other chases in contact with building envelope, are exempt from providing an internal air barrier along the fireplace chase walls. However, an air barrier must be installed along the exterior walls of the fireplace chase.

Example

There are two options for insulating and air sealing a fireplace chase on an exterior wall. The builder can either define the building envelope along the exterior walls of the fireplace chase or along the interior wall between conditioned space and the fireplace chase. All flues must be sealed to metal caps with appropriate sealant unless not allowed by local code.
Definitions
Attic kneewalls, defined as a vertical or near vertical wall separating conditioned space from unconditioned attic space, could include skylight shaft walls or walls adjacent to porch roofs. Changes in ceiling height 18” or greater are considered attic kneewalls.

Additional Resources
For information on the definition of Grade I insulation, see RESNET’s Mortgage Industries National Home Energy Rating Standards at: http://resnet.us/standards.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 1.9 Install weather-stripping

Criteria

1. At all exterior doors
   Install weather-stripping to all exterior doors that connect conditioned space to unconditioned spaces like the garage or outdoors.

2. At attic kneewall doors, scuttle holes and pull-down stairs
   Weather-strip all kneewall doors, scuttle holes and pull-down stairs that connect conditioned space to unconditioned attic areas. Kneewall doors must latch to provide tight closure. Install weather stripping prior to setting hinges on pull-down stairs to ensure tight closure of assembly between conditioned space and attic.

Figure 44: Kneewall weather-stripping
Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 1.10 All recessed can lights must be air tight, gasketed and IC-rated in insulated ceilings; in Climate Zone 4, insulate exterior surface of fixture to \( \geq R-10 \)

Criteria
Recessed light fixtures in insulated ceilings with an unconditioned area above must be air-tight and Insulation Contact (IC) rated, and must be fully gasketed and sealed to the drywall. Recessed can lights in Climate Zone 4 must be insulated to a minimum of R-10 to minimize condensation potential.
**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 1.11 Seal top plate to drywall**

**Criteria**
Seal top plate to drywall at all interfaces with appropriate sealant (gaskets, foam, caulk, etc.) between unconditioned spaces and wall. Sealant may be applied from attic side to joints between drywall and top plate.

Seal drywall to top plate for walls separating the conditioned space from garage space.

**Clarifications**
Construction adhesive is not permitted as sealant.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**BE 1.12 Air seal all electrical boxes on exterior walls**

**Criteria**
For electrical boxes installed on the outside of exterior walls, either install air-sealed electrical box or install air-barrier with appropriate material behind electrical box.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
BE 1.13 Seal drywall penetrations in

Criteria

1. **Non-insulated walls**
   Seal all penetrations in interior walls including wall switches, electrical outlets and plumbing penetrations to drywall using appropriate sealant.

2. **Insulated walls**
   Seal all penetrations in insulated walls including wall switches, electrical outlets and plumbing penetrations to drywall using appropriate sealant.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 1.14 Attic access with sealed cover or outside of building envelope

Criteria

Install sealed attic hatch cover that forms an airtight seal when closed. The attic hatch must accommodate the drop-down stairs and provide for full insulation depth.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 1.15 If ducts are in unconditioned attic; attic side radiant barrier or ENERGY STAR roof

Criteria

If more than 10 linear feet of ductwork are located in an unconditioned attic, install a radiant barrier with a minimum initial reflectance of 0.90 and maximum initial emittance of 0.10 on all sloped roofs above vented attics.
Install radiant barrier so that foil is facing down and not in direct contact with any building materials other than roof rafters.

Any uninsulated attic surfaces must have a radiant barrier installed. This includes sloped roof decks as well as gable end walls.

If more than 10 linear feet of ductwork are located in an unconditioned attic, install ENERGY STAR qualified roof product on 75% of total roof area (including attached garages).

**Clarifications**
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at: http://www.energystar.gov

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<td>- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.</td>
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**Blower door test**

**BE 2.0 Envelope leakage ratio <0.50 or 7 ACH50, whichever requires a lower CFM50**

**Criteria**
The envelope leakage ratio (ELR) must be less than 0.50 or 7 ACH50, whichever requires a lower CFM50.

**Definitions**

**ELR**

\[
ELR = \frac{cfm_{50}}{SFBE} 
\]

The volume of air in cubic feet per minute moved through the fan to maintain a 50 Pa pressure difference between the house and outside.

**SFBE**
The square footage of building envelope.

\[
SFBE = \text{Area of Slab} + \text{Insulated Walls} + \text{Insulated Floor over Garage} + \text{Insulated Ceiling separating the Conditioned Space from the Attic}
\]

**Clarifications**
Floor area must equal conditioned floor area used for the confirmed HERS energy model.
Example

The following diagram represents a two-story home on a slab with a flat ceiling and ventilated attic. The home has an attached 20’x20’ garage.

![Sample floor plan](image)

**Figure 49: Sample floor plan**

Slab = (40 ft x 40 ft) - (20 ft x 20 ft) = 1,200 ft²

Insulated Walls = 20 ft x (40 ft x 4) = 3,200 ft²

Insulated Floor Over Garage = (20 ft) x (20 ft) = 400 ft²

Ceiling separating the Conditioned Space from the Attic = (40 ft) x (40 ft) = 1,600 ft²

SFBE = 1,200 ft² + 3,200 ft² + 400 ft² + 1,600 ft² = 6,400 ft²

BLOWER DOOR TEST RESULT: 2,000 cfm at 50 Pa pressure (2,000 cfm₅₀)

CALCULATION: ELR = 2,000 cfm₅₀ / 6,400 SFBE = 0.32 ELR

![Blower door](image)

**Figure 50: Blower door**
**BE 2.1 ***Envelope leakage ratio <0.40 or 5 ACH\textsubscript{50}, whichever requires a lower CFM\textsubscript{50}**

**Criteria**
For states that have adopted IECC 2012, the envelope leakage ratio (ELR) must be less than 0.40 or 5 ACH\textsubscript{50}, whichever is requires a lower CFM\textsubscript{50}.

**Clarifications**
***This is only a requirement for homes located in states that have adopted the 2012 IECC.

**Confirmation**
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

**BE 2.2 Improved envelope leakage ratio**

**Criteria**

A. ***Envelope leakage ratio ≤0.40 or 5 ACH50, whichever requires a lower CFM***
These points are only available for homes located in states that have NOT adopted the 2012 IECC.

B. *Envelope leakage ratio ≤0.25 or 3 ACH50, whichever requires a lower CFM50*
These points are available to all homes meeting these envelope leakage criteria.

**Clarifications**
See BE 2.0 for definitions, clarifications and example.

**Confirmation**
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.
**Insulation**

**BE 3.0 Floors**

**Criteria**

1. *Framed ≥ R-19*

   Insulate framed floor over enclosed unconditioned spaces to R-19 or greater.

   Insulation must be in permanent contact with subfloor, or a fully aligned air barrier on the exterior side of the conditioned space provided that the perimeter rim and band joists of the floor cavity are also sealed and insulated to comply with the insulation and air sealing requirements for walls.

![Figure 51: Floor insulation supports](image)

2. *Cantilevered/Over exterior spaces ≥ R-30*

   Block between joists and insulate all floors with conditioned space over ambient areas to R-30 or greater. Blocking between joists is required when joists cross from unconditioned spaces to conditioned spaces.
Clarifications
Framed floors over basement/crawlspace only require insulation if basement/crawlspace is outside of building envelope.

Trade-off to R-19 or greater is allowed in cantilevered floors/floors over exterior spaces using the performance path based on energy performance analysis.

If insulating a steel joist floor, R-6 continuous insulation must be installed in addition to floor insulation listed above.

Enclosed unconditioned spaces typically include vented crawlspace, unconditioned basement, garage, etc.

Conditioned spaces over ambient areas typically include floors over carports, cantilevered floors, etc.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 3.1 Walls

Criteria

1. Exterior walls and band joist ≥R-13

   Climate Zone 4 – R-13 +1 continuous or R-15 cavity

   Install insulation on all exterior walls ≥R-13, including air-barriers behind showers and tubs on exterior walls. Cut batts in narrow cavities and around plumbing and wiring to fit per manufacturer’s specifications, or fill narrow cavities with sprayed/blown insulation.
2. **Fireplace chase(s) on exterior walls R-13**

Exterior fireplace chase which connects to conditioned space must be insulated to \( \geq R-13 \). Insulation must be in continuous contact with exterior walls and ceiling above. Insulation must be located no closer than 1” to the flue pipe, or according to local code, whichever is more stringent.

![Figure 53: Fireplace chase insulation](image)

3. **Foundation walls:**

   **Climate Zone 2/3:** \( \geq R-5 \) continuous or \( \geq R-13 \) cavity

   **Climate Zone 4:** \( \geq R-10 \) continuous or \( \geq R-13 \) cavity

Insulate foundation walls in Climate Zones 2 and 3 to minimum R-5 continuous or R-13 cavity insulation. Insulate foundation walls in Climate Zone 4 to minimum R-10 continuous or R-13 cavity insulation.

![Figure 54: Foundation wall insulation](image)
Clarifications
If insulating a steel studded wall or steel header, R-5 continuous insulation must be installed in addition to wall insulation listed above.

Garage walls are considered exterior walls.

Foundation walls require insulation if inside building thermal envelope.

Insulation must be in permanent contact with foundation wall.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 3.2 Ceilings

Criteria

1. Flat: Climate Zone 2/3 ≥R-30, Climate Zone 4 ≥R-49
In flat ceilings, install insulation ≥R-30 in Climate Zones 2 and 3; Install insulation ≥R-49 in Climate Zone 4. Continue full depth of insulation over perimeter top plates.

Figure 55: Full insulation over top plate
2. **Sloped: Climate Zone 2/3 ≥R-30, Climate Zone 4 ≥R-38**

In sloped ceilings with attic above, install insulation greater than or equal to R-30 in Climate Zones 2 and 3; install insulation greater than or equal to R-38 in Climate Zone 4.

**Clarifications**

Flat ceiling insulation not installed to full depth (e.g., under attic platforms, over wall top plates at eaves, etc.) must be modeled at actual installed R-value but may not be modeled or installed less than R-21, and no more than 500 sq ft or 20% of the total insulated ceiling area, whichever is less, may be less than R-30 in Climate Zones 2 and 3 and R-38 in Climate Zone 4.

**Figure 56: Raised joist to accommodate for insulation under attic platform**

Sloped ceilings with ambient above (e.g., cathedral ceilings) are not addressed under this criteria and shall be addressed as part of the following EarthCraft criteria: “Insulate roofline of attic to create unvented attic ≥R-19”.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

**BE 3.3 Attic/Roof**

**Criteria**

1. **Install wind baffles at eaves in every vented bay, or equivalent air barrier at edge of ceiling**

   Install wind baffles or blocking at eaves to prevent wind washing over insulation. Include a baffle in every bay or a tabbed baffle in each bay with a soffit vent that will also prevent wind washing of insulation in adjacent bays.
2. **Energy heel trusses or raised top plates**

Install energy heel trusses or raised top plates to ensure full depth of attic insulation above exterior wall top plates. Depth of insulation above top plate may be traded to R-21 when allowed by code and reflected in the energy model.

![Diagram of Energy heel truss and raised top plate](image)

**Figure 57: Energy heel truss (top), raised top plate (bottom)**

3. **Attic platforms allow for full-depth insulation below**

Raise attic platforms to allow for full depth of insulation below meeting minimum flat ceiling R-value requirement. Access to equipment or storage with attic platform must be maintained without compressing insulation.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
**BE 3.4 Attic kneewall**

**Criteria**

1. **Doors: Climate Zone 2/3 ≥R-18, Climate Zone 4 ≥R-19**
   
   Insulate doors separating conditioned space from unconditioned attic spaces to R-18 or greater in Climate Zones 2 and 3, and R-19 or greater in Climate Zone 4. Attic kneewall doors must allow for full depth of minimum R-value insulation when opened preventing damage of insulation overtime.

2. **Insulation and attic side air barrier: Climate Zone 2/3 ≥R-18, Climate Zone 4 ≥R-19**
   
   Install rigid attic side air barrier (e.g., foam board, plywood, OSB) along all kneewalls separating conditioned space from unconditioned attic space. Air barrier must align with bottom and top plates of attic kneewall to provide full insulation encapsulation on all 6 sides. Insulate kneewalls separating conditioned space from unconditioned attic space to R-19 or greater in Climate Zones 2 and 3, and to R-19 or greater in Climate Zone 4. Insulation must be in contact with attic side air barrier.

**Example**

A 2x4 wall assembly with R-13 batts and R-5 continuous rigid insulation, or a 2x6 wall assembly with R-19 batts.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.
BE 3.5 Attic pull-down/scuttle hole: Climate Zone 2/3 ≥R-30, Climate Zone 4 ≥R-38

Criteria
Install pull-down attic stairs separating conditioned space from unconditioned attic space with an insulated box or other cover equal to or greater than R-30 in Climate Zones 2 and 3 and R-38 in Climate Zone 4.

Insulate scuttle holes separating conditioned space from unconditioned attic space with batt insulation or rigid foam insulation equal to or greater than R-30 in Climate Zones 2 and 3 and R-38 in Climate Zone 4.

Clarifications
Insulation must completely cover rough opening of pull-down stairs. Compressed batts are not acceptable.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 3.6 If installed, whole house fan has sealed, insulated cover ≥R-19

Criteria
If whole house fan is installed, install a whole house fan cover that is constructed to air seal and insulate the whole house fan to R-19 or greater. Install cover on the house side of the ceiling or provide mechanical operation for homeowner convenience. Instruct home owner to remove cover before operating the fan and replace cover during seasons when not in use.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 3.7 If loose-fill attic insulation, card and rulers must be installed

Criteria
Install attic rulers facing the attic entrance every 300 sq ft to verify insulation depth. Post in the attic written documentation (an “attic card”) specifying the insulation type, coverage area, and R-value.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

BE 3.8 Slab edge insulation: Climate Zone 2/3 ≥R-4, Climate Zone 4 ≥R-10

Criteria
Install exterior slab insulation (Climate Zone 2/3 ≥R-4 (heated slabs ≥R-5), Climate Zone 4 ≥R-10 (heated slabs ≥R-15) so that it extends to the top of the slab. Slab edge insulation must extend to the bottom of the footing or 2’ whichever is less.
Clarifications
Where an insulated wall separates a garage, patio, porch or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab, unless the slab is post-tensioned with integrated garage or porch foundations.

For exterior slab edge insulation, such as for monolithic slabs, install insulation with approved membranes, such as EPDM-type membranes, to protect against termites.

Non-monolithic slabs may use rigid insulation between the stem wall and the poured (floating) slab, using the protective membrane as a termite flashing and as a capillary break.

If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall.

Exemptions
Slab edge insulation is not required in jurisdictions designated by the local code official as having a very heavy termite infestation.

Slabs greater than 12” below grade as measured from the top of the slab are not required to have insulation.
Confirmation

- The builder will illustrate compliance through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder at pre-drywall.

BE 3.9 Insulation installation quality (floors, walls and ceilings)

Criteria

1. **GRADE I**
   
   Install all insulation per manufacturer’s recommendations to achieve quality Grade I as specified by criteria set forth by RESNET.

Additional Resources

For more details on the RESNET insulation installation quality refer to Appendix A of RESNET Mortgage Industry National HERS Standards at:
http://resnet.us/standards/RESNET_Mortgage_Industry_National_HERS_Standards.pdf

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

BE 3.10 Corners ≥R-6

Criteria

Insulate the intersecting corner of two walls separating conditioned and unconditioned space to greater than or equal to R-6 so that insulation is continuous in the external wall.
Clarifications
The “California corner” (i.e., two-stud corner with drywall clips or deadwood nails) is one method of meeting this requirement.

The corner must be fully insulated to achieve the intent; therefore corners with more than three studs are not permitted.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

BE 3.11 Headers ≥R-3

Criteria
Insulate all headers on walls separating conditioned and unconditioned space to greater than or equal to R-3.
Clarifications
The R-value requirement refers to the insulation manufacturer’s nominal insulation value.

Examples
Methods include substituting 1/2” plywood spacer with 1/2” rigid foam insulation, boxed headers with cavity insulation, pre-manufactured insulated headers, SIP headers and continuous rigid insulation sheathing.

Exemptions
Headers on exterior walls where the structural engineered framing layout indicates that full-depth solid headers are the only acceptable option are exempt from being insulated

| Confirmation | The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection. |

BE 3.12 Insulate with spray applied insulation

Criteria
1. *Band joist*
   Permanently install spray applied insulation in the band joist.

2. *Walls*
   Install spray applied wall insulation to a minimum of 90% of all wall cavities adjacent to unconditioned spaces, including walls adjacent to the exterior, garage, unconditioned attic and crawlspace and all band joist areas between floors.

Clarifications
Installed insulation must meet RESNET Grade I criteria.

Not all spray applied insulation products have self-adhesion properties and therefore may require an air barrier or net to ensure continued contact with band joist.

| Confirmation | The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection. |

BE 3.13 Walls

Criteria
1. *Seal and insulate crawlspace walls:*
   *Climate Zone 2/3* ≥R-5 continuous
   *Climate Zone 4* ≥R-10 continuous

   Permanently install insulation to crawlspace walls and extend downward from the termite inspection strip to within 9” of the finished interior grade adjacent to the foundation wall.

   Provide a 3” inspection strip immediately below the floor joists to allow inspection for termites. (The inspection strip may be insulated with a removable section of insulation, but is not required to be insulated.)

   An additional strategy required to meet this credit intent is DU 1.8 If installed, crawlspace must be closed.
2. Insulate exterior walls and band joist ≥R-20
Install wall stud and band joist cavity insulation to R-20 or greater in a minimum of 90% of all exterior framed walls and band joists adjacent to unconditioned spaces. Insulation must be installed according to manufacturer’s specifications and meet RESNET Grade II criteria or better.

Clarifications
Paper-faced batts may not be used on masonry walls.

Additional Resources
For more detailed information on enclosing crawlspace, refer to www.crawlspaces.org.

For more details on the RESNET insulation installation quality refer to Appendix A of RESNET Mortgage Industry National HERS Standards at:

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

BE 3.14 No fireplaces on exterior walls

Criteria
Design and construct home so that no fireplaces are located on exterior walls.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
**BE 3.15 Insulated wall sheathing**

**Criteria**

1. ≥R-3 (75%)  
   Install R-3 or greater insulated sheathing on at least 75% of exterior walls. Install sheathing to have no gaps greater than 1/4” and provide complete coverage except where structural sheathing is required by code (maximum of 25%).

2. ≥R-3 (100%)  
   Install R-3 or greater insulated sheathing on all exterior walls. Install sheathing to have no gaps greater than 1/4” and provide complete coverage. Where structural sheathing is required by code, install a structurally rated insulated sheathing or over-sheath using insulated sheathing.

**Clarifications**  
Insulated siding may not be substituted for insulated wall sheathing without preapproval by EarthCraft.

**Confirmation**  
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**BE 3.16 Insulate roofline of attic with spray foam to create unvented attic ≥R-19**

**Criteria**  
Insulate roofline of attic using foam insulation ≥R-19 to create an unvented attic.

*Figure 63: Air impermeable insulation along roofline*
Clarifications

Ridge, soffit, gable or other attic ventilation is prohibited.

Combustion appliances installed in attic must be direct vent or sealed combustion.

Manufacturer recommended installation procedures and ignition barrier code requirements must be followed.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

Windows and Doors

BE 4.0 NFRC certified Doors, windows and skylights with label

Criteria

Install doors, windows and skylights labeled by the National Fenestration Rating Council (NFRC).

Exemptions

Up to 15 sq ft of glazing are exempt from this requirement.

Confirmation

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
**BE 4.1 Window U-factor and SHGC**

**Criteria**

1. **U-factor: Climate Zone 2 ≤ 0.45, Climate Zone 3 ≤ 0.35, Climate Zone 4 ≤ 0.32**
   
   All windows in Climate Zone 2 must have a U-factor less than or equal to 0.45.
   
   All windows in Climate Zone 3 must have a U-factor less than or equal to 0.35.
   
   All windows in Climate Zone 4 must have a U-factor less than or equal to 0.32.

2. **SHGC: Climate Zone 2/3/4 ≤ 0.27**
   
   All windows in Climate Zones 2, 3 and 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.27.

**Clarifications**

If the total window and skylight to conditioned floor area (WFA) ratio is greater than 15%, then builder must install windows with a U-factor less than or equal to an improved U-factor, where the improved U-factor = \( \frac{0.15}{WFA} \times \text{U-factor minimum} \), and with a SHGC less than or equal to an improved SHGC, where the improved SHGC = \( \frac{0.15}{WFA} \times \text{SHGC minimum} \).

Prescriptively, 0.75% window to conditioned floor area (WFA) ratio, up to 15 square feet of window area, may be used for decorative glass that does not meet this requirement.

A performance approach demonstrating energy tradeoffs may be taken by homes with more than 15 square feet of decorative glazing.

Floor area must equal conditioned floor area used for the confirmed HERS energy model.

**Example #1**

A home in Climate Zone 3 with a conditioned floor area of 2,000 sq ft and 400 sq ft of windows (composed of 350 sq ft of windows, 35 sq ft of skylights and 15 sq ft of decorative glass) (WFA=400/2000=0.2) must meet a minimum U-factor of 0.26 (where improved U-factor = 0.15/0.20 x 0.35).

**Example #2**

For example, a home with total conditioned floor area of 2,000 sq ft may have up to 15 sq ft (0.75% of 2,000) of decorative glass.

**Confirmation**

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**BE 4.2 Skylight U-factor and SHGC**

**Criteria**

1. **U-factor: Climate Zone 2 ≤ 0.70, Climate Zone 3 ≤ 0.57, Climate Zone 4 ≤ 0.55**
   
   All skylights in Climate Zone 2 must have a U-factor less than or equal to 0.70.
   
   All skylights in Climate Zone 3 must have a U-factor less than or equal to 0.57.
   
   All skylights in Climate Zone 4 must have a U-factor less than or equal to 0.55.
2. **SHGC: Climate Zone 2/3/4 ≤0.27**

All windows in Climate Zones 2, 3 and 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.27.

**Clarifications**

If the total window and skylight to conditioned floor area (WFA) ratio is greater than 15% then builder must install windows with a U-factor less than or equal to an improved U-factor, where the improved U-factor = \(0.15 / \text{WFA}\) x \[\text{U-factor minimum}\], and with a SHGC less than or equal to an improved SHGC, where the improved SHGC = \(0.15 / \text{WFA}\) x \[\text{SHGC minimum}\].

Floor area must equal conditioned floor area used for the confirmed HERS energy model.

**Confirmation**

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

### BE 4.3 Install ENERGY STAR certified door(s)

**Criteria**

Install ENERGY STAR certified doors for all doors separating conditioned space from unconditioned space.

**Confirmation**

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

### BE 4.4 Window U-factor and SHGC

**Criteria**

1. **U-factor:** Climate Zone 2 ≤0.35, Climate Zone 3 ≤0.30, Climate Zone 4 ≤0.25

All windows in Climate Zone 2 must have a U-factor less than or equal to 0.35.

All windows in Climate Zone 3 must have a U-factor less than or equal to 0.30.

All windows in Climate Zone 4 must have a U-factor less than or equal to 0.25.

2. **SHGC:** Climate Zone 2/3/4 ≤0.24

All windows in Climate Zones 2, 3 and 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.24.

**Clarifications**

Up to 15 square feet of window area, may be used for decorative glass that does not meet this requirement.

**Confirmation**

- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
Energy Efficient Systems

Constructing an energy-efficient home provides variety of benefits to both a home’s occupants and to the environment. Once the building envelope has been designed, evaluating heating and cooling systems, ventilation, domestic water heating, lighting and appliances using the house-as-a-system approach is critical to achieving a high performance home.

An energy efficient home not only saves a resident on their utility bills but also improves their comfort and health. Comfort is a function of air temperature, relative humidity and radiant heating and cooling, all of which are impacted by the energy systems used in a home. In addition, using less energy reduces the need to extract natural resources, reduces air pollution and eases the strain on our water resources. Buildings account for about 40% of all energy use in the United States. EarthCraft encourages the use of energy efficient systems to reduce this impact.

Heating and Cooling

ES 1.0 Size and select all HVAC equipment with ACCA Manuals J and S

Criteria

Size and select all HVAC equipment in accordance with ACCA Manuals J and S. Load calculation must coordinate with accurate construction specifications and plans for the project as well as as-built conditions.

1. **Complete load calculation with accredited ACCA Manual J 8th Edition Software or stamp by a Professional Engineer**

   Load calculation must be based on ACCA Manual J 8th Edition Software. The following software programs are ACCA Manual J 8th Edition compliant:

   - Wrightsoft Right-J8
   - Elite RHVAC
   - Adtek AccuLoads
   - Florida Solar Energy Center’s EnergyGauge

   OR

   Load calculation must be stamped by a Professional Engineer along with a signed “Professional Engineer Load Calculation Affidavit”.

2. **Base on actual house orientation**

   Load calculation must be based on actual home orientation as constructed.

3. **Use most current ASHRAE Handbook of Fundamentals Climate Design Information for outdoor design temperatures**

   Design heating and cooling systems using the annual outdoor design conditions as defined in the most current ASHRAE Handbook of Fundamentals.

   The 99% design conditions must be used to size heating equipment

   The 1% design conditions must be used to size cooling equipment

4. **Indoor temperatures 70°F for heating and 75°F for cooling**

   Design heating and cooling systems using indoor design temperatures of 70°F for heating and 75°F for cooling.
5. **Base infiltration on “semi-tight” or tighter**  
Select “semi-tight” or tighter software equivalent for whole house infiltration.

6. **Base duct tightness on “notably sealed” or tighter**  
Select “notably sealed” or tighter software equivalent for duct tightness.

7. **Use actual area, U-factor and SHGC for windows and doors, actual area and R-values of floors, walls and ceilings**  
Load calculation must be based on actual window, insulation and door specifications as installed. Window, door, wall, floor and ceiling areas must be ±10% of actual areas as constructed.

8. **Base on ASHRAE 62.2 – 2007 ventilation loads or Building Science Corporation Standard 01-2013**  
Load calculation must be based on ventilation system designed and installed to meet ASHRAE 62.2-2007 or Building Science Corporation Standard 01-2013. This includes the ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.

9. **Cooling equipment and/or single-stage heat pump between 95-115% (≤125% for heat pump in Climate Zone 4)**  
Cooling equipment selection must be between 95-115% of load calculation or the next available size unit. Installed heat pumps in Climate Zone 4 must be within 125% of load calculation or the next available size unit.

**Clarifications**  
The abridged edition of ACCA Manual J is not an acceptable methodology within the EarthCraft program.

Multispeed or multistage equipment may have OEM nominal size increments of one ton. Therefore, the use of multispeed or multistage equipment can provide extra flexibility to meet the equipment sizing requirements. The equipment oversizing limit shall be based on the largest capacity of the unit.

Floor area must equal conditioned floor area used for the confirmed HERS energy model.

**Example #1**  
Equipment sizing selection:

If the load calculation specifies a total sensible load of 36,000 Btuh, the 115% oversizing limit allows for using up to 41,400 Btuh:

\[
36,000 \times 1.15 = 41,400 \text{ Btuh}
\]

If Manufacturer X (the trusted brand of Builder Y) makes a nominal 3 ton unit and a nominal 4 ton unit, but no sizes in between, then Builder Y may install the 4 ton unit made by Manufacturer X as long the nominal 3 ton unit has insufficient capacity (i.e. total capacity of 33,000 Btuh). Alternately, if Builder Y wanted to use equipment from Manufacturer Z and Manufacturer Z offers nominal 3 ton (33,000 Btuh), 3.5 ton (39,400 Btuh) and 4 tons units (45,800 Btuh), then Builder Y must install the nominal 3.5 ton unit by Manufacturer Z because the unit is between the Manual J specification and the 115% oversizing limit required by EarthCraft.
Example #2
The Builder meets with the HVAC contractor regarding the scope of work for the project including this line item. The HVAC contractor provides a Manual J load calculation to the builder that matches the construction specifications, plans, intended construction, and appropriate items on the EarthCraft Worksheet. Prior to submitting the documentation to the EarthCraft Technical Advisor, the builder randomly selects one of each window, door, wall, floor and ceiling for area, U-factor and SHGC to confirm that the load calculation and associated HVAC sizing meets the criteria intent. Then, prior to submittal to EarthCraft, the EarthCraft Technical randomly selects one of each window, door, wall, floor and ceiling for area, U-factor and SHGC to confirm that the load calculation and associated HVAC sizing meets the criteria intent.

Additional Resources
Air Conditioning Contractors of America, see www.acca.org.

To download the Professional Engineer Load Calculation Affidavit, see http://www.jotform.com/form/11922230277.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor prior to the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

ES 1.1 Programmable thermostat (all systems except heat pumps)

Criteria
All heating and cooling equipment, except heat pump systems, must have a programmable indoor thermostat or thermidstat installed according to the manufacturer’s specifications.

Clarification
Not all digital thermostats are programmable thermostats.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
ES 1.2 Adaptive recovery thermostat (all heat pumps)

Criteria
If a heat pump is installed and a programmable thermostat is used, thermostat must be equipped with adaptive recovery technology.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

ES 1.3 AHRI performance match all indoor/outdoor coils

Criteria
Indoor and outdoor coils must be matched in accordance with Air-Conditioning, Heating and Refrigeration Institute (AHRI) standards.

Additional Resources

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

ES 1.4 No electric resistance heat as primary heat source

Criteria
Electric resistance heaters, such as an electric furnace, electric radiant or a baseboard heater, may not be used as the primary heat source for any portion of the conditioned space.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

ES 1.5 Heating equipment efficiency

Criteria

1. *Furnace(s) ≥90% AFUE and within 40% of load calculation*

All heating equipment must be 90%+ Annual Fuel Utilization Efficiency (AFUE) for gas combustion furnaces. All furnaces must be sized within 40% of the heating load as determined by the load calculation.
2. **Heat pump(s) Climate Zone 2/3 ≥8.2 HSPF and within 15% of load calculation, Climate Zone 4 ≥8.5 and within 25% of load calculation**

All heating equipment must be meeting an 8.2+ Heating Seasonal Performance Factor (HSPF) for heat pumps in Climate Zones 2 and 3 or 8.5 HSPF in Climate Zone 4.

Heat pumps in Climate Zones 2 and 3 must be within 15% of the load calculation or the next available size. Heat pumps in Climate Zone 4 must be within 25% of the load calculation or the next available size.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

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**ES 1.6 Ground-source heat pump(s) of ≥15 EER (if installed)**

**Criteria**
Install ground-source heat pump(s) of ≥15 EER for whole-house heating and cooling.

**Additional Resources**
A list of qualified products can be found at: http://www.energystar.gov.

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

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**ES 1.7 Qualified cooling equipment ≥14 SEER split system or ≥12 EER package unit in all Climate Zones**

**Criteria**
Install high efficiency cooling equipment (SEER 14+) or install high efficiency cooling equipment with an EER ≥12. All cooling equipment must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 14 for split systems or a minimum of 12 Energy Efficiency Ratio (EER) for package units.

**Additional Resources**
A list of qualified products can be found at: http://www.energystar.gov.

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.
ES 1.8 Verify proper refrigerant charge and total system airflow within 20% of design airflow

Criteria
Perform refrigerant charge test to ensure appropriate charge for HVAC equipment with subcooling deviation ±3°F or superheat deviation ±5°F. Document test results on EarthCraft Refrigerant Charge Test Sheet or ENERGY STAR HVAC Quality Contractor Installation Checklist.

Perform airflow test using a flow hood, anemometer or other EarthCraft approved equivalent to ensure total system airflow is within 20% of the design airflow.

Clarifications
This requirement may be met by any of the following methods according to ACCA 5 QI-2007:

- Superheat method test measurement within 5% of the manufacturer-recommended charge
- Subcooling method test measurement within 3% of the manufacturer-recommended charge
- Other equivalent method/tolerance approved by the equipment manufacturer

Geothermal heat pumps, mini-split heat pumps and hermetically sealed factory-charged stems may not be appropriate for standard subcooling or superheat refrigerant charge testing. To accommodate these system types, an OEM (original equipment manufacturer) test procedure may be used and documented.

Additional Resources
The EarthCraft Refrigerant Charge Test Sheet is available as a tab in the EarthCraft Worksheet.

<table>
<thead>
<tr>
<th>Confirmation</th>
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<tbody>
<tr>
<td>Refrigerant Charge</td>
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<tr>
<td>- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.</td>
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<tr>
<td>- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.</td>
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<th>Total System Airflow</th>
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<td>- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.</td>
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<tr>
<td>- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection, or be present to observe the test being completed by the HVAC contractor and confirm test results comply with criteria.</td>
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</table>

ES 1.9 Locate ducts within conditioned space (≥90%)

Criteria
Locate at least 90% of all supply and return ducts within conditioned space.
ES 1.10 Cooling equipment ≥15 SEER or ≥13 EER

Criteria
Install high efficiency cooling equipment (SEER 15+). All cooling equipment must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 15 or a minimum of 13 Energy Efficiency Ratio (EER) showing the SEER rating of each unit.

Additional Resources
A list of high efficiency cooling equipment products can be found at:

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

ES 1.11 Variable speed blower

Criteria
Install variable speed blower fan to allow for improved humidity removal and quieter operation. System must be installed such that static pressure across the blower with filter installed is within manufacturer specifications.
Clarifications
Multi-speed air handlers do not meet this credit intent.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

ES 1.12 Dual-stage compressor

Criteria
All cooling equipment must have a dual-stage (or two-stage) compressor for improved humidity removal and increased efficiency. The higher stage compressor must comply with the maximum 15% oversizing criteria as required for all cooling equipment.

Clarifications
When a dual-stage compressor is used for a heat pump to lower the balance point, size the air conditioner at design conditions for the lower fan speed only. The second stage shall not come on at design temperatures. Use the second stage to size the heat pump at design heating conditions.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

ES 1.13 Zone control (only available if used with variable speed air blower):

Criteria
1. **One system serves multiple zones, with dampers**
   Install wired damper controls and thermostats that allow one HVAC system to serve multiple zones.

2. **If zoned control, zoned returns or transfer grills between zones**
   If using one HVAC system to serve multiple zones, meet Criteria A, and install wired damper controls on each zoned return or install transfer grills between zones to prevent pressure imbalances between separate conditioned areas.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

ES 1.14 High efficiency HVAC equipment

Criteria
Install high efficiency HVAC equipment meeting one of the following criteria for all systems.
A. **Ground-source heat pump(s) ≥17 EER**
Install a ground-source heat pump for whole-house heating and cooling. All ground-source heat pumps must have a minimum cooling Energy Efficiency Ratio (EER) of 17 and a minimum heating Coefficient of Performance (COP) of 3.5 as determined by the Air Conditioning, Heating and Refrigeration Institute (AHRI).

B. **Cooling equipment ≥16 SEER or ≥13 EER**
Install high efficiency cooling equipment (SEER 16.0+). All cooling equipment must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 16.0 or a minimum of 13 Energy Efficiency Ratio (EER) showing the SEER rating of each unit.

C. **Mini-split cooling equipment ≥16 SEER**
Install mini-split cooling equipment for whole-house heating and cooling. All systems must have a minimum cooling Seasonal Energy Efficiency Ratio (SEER) of 16 as determined by the Air Conditioning, Heating and Refrigeration Institute (AHRI).

**Clarifications**
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at:  http://www.energystar.gov.


**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

**ES. 1.15 Cooling equipment between 95 – 115% of load calculation (not next nominal size)**

**Criteria**
Cooling equipment selection between 95-115% of load calculation.

**Clarifications**
Multispeed or multistage equipment may have OEM nominal size increments of one ton. Therefore, the use of multispeed or multistage equipment can provide extra flexibility to meet the equipment sizing requirements. The equipment oversizing limit shall be based on the largest capacity of the unit.

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.
**Ductwork/Air handler**

**ES 2.0 Seal air handlers and duct systems with mastic**

**Criteria**
Seal all seams, joints and connections in forced-air delivery systems using mastic paste or Butyl rubber backed foil tape (mastic tape), including but not limited to:

- Supply and return ducts
- Supply and return plenums
- Duct-to-plenum connection
- Y-splits, butt joints and boot connections
- Outdoor air intakes
- Air handler condensate and refrigerant line, wire penetrations and unused holes in the air handler cabinet

Wrap mastic tape at least two times around duct seam touching at least 1 1/2” of duct inner liner and metal collar or sleeve. Assemble duct board using code-approved foil tape and coat seams with layer of mastic paste covering seams by 1.5” on both sides and as thick as a nickel.

**Clarifications**
Duct tape is not a suitable sealant for ducts. Foil tape may only be used for sealing leaks at the air handler’s removable access panels and at filter access panels. Duct boots may be sealed to floor, wall, or ceiling using caulk, foam, mastic tape or mastic paste.

*Figure 67: Common mastic locations*
ES 2.1 Code approved solid connector for all flex to flex connections

Criteria
Connect all flex-to-flex duct connections together using code approved rigid connectors or sleeves. Connect flex duct liner to sleeve using a duct tie and mastic paste or Butyl rubber backed foil tape (mastic tape).

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.
**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

---

**ES 2.2 Install rigid duct work or pull all flex ducts with no pinches and support at intervals ≤5’**

**Criteria**
Construct all duct work using rigid duct materials (sheet metal or duct board) or ensure all flex duct is pulled tight and that inner liner is not constricted to allow for optimal airflow. Bends in flex duct must have a radius of at least the diameter of the duct or more. Use balancing dampers instead of loops to limit flow to diffusers, and use baffles for acoustical control. Support flexible ducts at intervals recommended by the manufacturers but at least every 5 feet using bands that are at least 1 1/2” wide, with no more than 2” sag between supports and located above ceiling insulation to prevent condensation.

Or use the Air Diffusion Councils standards, located here: [http://www.flexibleduct.org/ADC_Pubs.asp](http://www.flexibleduct.org/ADC_Pubs.asp)

**Clarifications**
- Do not install ducts in contact with roof decking.
- Do not install flex duct located in unconditioned spaces in cavities smaller than the outer duct diameter or flex duct located in conditioned spaces in cavities smaller than the inner duct diameter.

**Examples**

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**Figure 70: Correct (top) and incorrect (bottom) ductwork installation**
ES 2.3 Fully duct all supply and return ducts

Criteria
Install all supply and return ducts using code approved air duct materials.

Clarifications
Do not use building cavities as a supply duct (e.g., panned joists and stud cavities are not allowed as supply or return ducts).

Supplies located in toe kicks must be fully ducted and sealed to the exterior face of the toe-kick.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
ES 2.4 No ducts in exterior walls or vaulted ceilings

Criteria
Design and install duct layout such that no ducts are located in exterior walls or insulated vaulted ceilings. This includes insulated walls between conditioned and unconditioned space such as the common wall between the garage and the home.

Clarifications
Ducts in exterior walls may be installed if a minimum of R-6 continuous insulation (in addition to the required duct and wall insulation) is provided on the exterior side of the cavity with an interior and exterior air barrier, and the wall cavity is large enough to accommodate the full duct diameter with no crimps.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

ES 2.5 Ducts suspended above attic floor trusses to allow for full depth of attic floor insulation

Criteria
Suspend ductwork above attic floor trusses to allow for full depth of attic floor insulation. Ductwork in contact with attic floor insulation is acceptable within 4’ of trunk line and duct boot terminations.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

ES 2.6 Duct insulation

Criteria
1. R-8: Unconditioned attics and exterior locations
Insulate all ducts and all duct connections in unconditioned attics and exterior locations using R-8 insulation or greater.

2. R-3: All conditioned space
All ducts in conditioned spaces must be insulated to R-3.

Clarifications
Ducts left completely exposed inside conditioned space (e.g., modern loft-style duct systems) are not required to be insulated, but must be 90% visible at final inspection.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.
ES 2.7 HVAC system and ductwork is dry and clean

Criteria
Inspect ductwork before installing registers, grilles and diffusers to verify it is dry and substantially free of dust or debris, and that there are no disconnects or visible air gaps.

Inspect air-handling equipment and verify that heat exchangers/coils are free of dust caused by construction activities and the filter is new. After installation of registers, grilles and diffusers, verify detectable airflow from each supply outlet.

Clarifications
If duct openings were uncovered during construction, thoroughly vacuum out each opening prior to installing registers, grilles and diffusers.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria with the builder at the final inspection.

ES 2.8 Improved duct design

Criteria

1. Install ducts per ACCA Manual D duct design
Design and install ductwork in accordance with ACCA Manual D guidelines latest edition. Integrate duct layout with construction documentation to ensure proper installation and provide clash detection. At a minimum, duct layout must document duct diameter and length, and register location.

2. Measure and balance airflow for each duct run (±20% of design)
Measure and balance airflow for each room using a flow hood, anemometer or EarthCraft approved equivalent with all interior doors closed. Adjust airflow to within the greater of ±20% or 25 cfm of the load calculation room-by-room specifications.

3. Verify supply and return duct static pressure
Verify supply and return duct static pressure is within manufacturer and design specifications to have the capacity to meet the calculated loads.

Clarifications
Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control as noted in the duct design.

Balancing dampers or proper duct sizing shall be used instead of loops to limit flow to diffusers.

When balancing dampers are used, they shall be located at the trunk to limit noise unless the trunk will not be accessible when the balancing process is conducted. In such cases, opposable blade dampers or dampers located in the duct boot are permitted.

Pressure must be measured in the ducts and not in the air handler itself.

HVAC contractor test-hole locations must be well marked and easily accessible for verification. Supply and return duct static pressure measurements in inches of water column (IWC) must be submitted to builder by HVAC contractor.

Verification of static pressure using the same test holes must confirm results are <110% of contractor values.
**Confirmation**

*Install ducts per ACCA Manual D duct design*
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall inspection.

*Measure and balance airflow for each duct run*
- The builder must submit documentation demonstrating compliance to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder at the final inspection and diagnostically test to confirm compliance of criteria at the final inspection, or observe testing by HVAC contractor demonstrating compliance with criteria.

*Verify supply and return duct static pressure*
- The builder must submit documentation demonstrating compliance to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder at the final inspection and diagnostically test to confirm compliance of criteria at the final inspection, or observe testing by HVAC contractor demonstrating compliance with criteria.

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**ES 2.9 Install multiple return ducts, jumper ducts, transfer grills or measure pressure differential compliance (≤ 3 Pa)**

**Criteria**

Install a dedicated return duct, jumper duct or a transfer grill in each room with a door (except normally sized bathrooms and closets) to give supply air a direct path back to a return grill even when doors are closed.

AND

Provide at least 1 sq. in. of free area opening per 1 cfm of measured supply air if installing transfer grills and/or jumper ducts.

OR

Confirm pressures between rooms and main return pathways (e.g., hall main return) are less than or equal to 3 Pa when air handler is running at full speed (highest speed for multi-speed fans) and room door is closed.

AND

Dedicated returns must either meet the free area opening minimums or pressure differential compliance testing.
Figure 72: Return air pathways

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection or will diagnostically test compliance of criteria at the final inspection.

**ES 2.10 Duct design and installation**

**Criteria**

1. **No duct take-offs within 6” of supply plenum cap**
   Space all duct take-offs at least 6” away from supply plenum cap with no duct take-offs originating from the cap of the supply plenum.

2. **Rigid metal supply trunk line**
   Design and install all duct systems using the “trunk and branch” configuration. The trunk and branch configuration requires that each HVAC system has at least one rigid supply trunk with multiple, short branch take-offs to each supply register.

3. **Space all supply duct take-offs ≥6” apart**
   Space all supply duct take-offs at least 6” apart from each other with no duct take-offs originating from the cap of the supply plenum. Junction boxes with 4 take-offs or less and no take-off(s) directly opposite main supply to junction box are excluded.
**ES 2.11 Return plenum duct take-off free area is 120% of supply plenum duct take-off free area**

**Criteria**
Install all ductwork to provide capacity for at least 120% more return air than supply air for every system.

**Exemptions**
This line item is waived if the duct system is installed per Manual D.

---

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.
Example
A 2 ton system with a 0.09 friction rate has the following flex duct supply take-offs:

Two 10” ducts = 570 cfm
One 8” duct = 160 cfm
One 6” duct = 75 cfm

805 cfm total supply side

To achieve a return capacity that is at least 120% of the supply capacity, the system would need the following flex duct return take-offs:

Two 10” ducts = 570 cfm
Two 8” ducts = 320 cfm
One 6” duct = 75 cfm

965 cfm total return side

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

Duct Leakage Test Results

ES 3.0 Test duct leakage based on floor area served

Criteria

1. Leakage to outside $\leq 4\%$ (≤5% if conditioned floor area <1,200 sq ft)
Duct blaster test result for leakage to outside is equal to or less than 4% of floor area served. For homes that are less than 1,200 square feet, duct blaster test result for leakage to outside is equal to or less than 5% of floor area served.

2. Total leakage $\leq 6\%$
Duct blaster test result for total leakage is equal to or less than 6% of floor area served.

Definitions
Duct leakage is calculated using the standard protocol set forth by ASTM for duct pressurization testing at 25 Pascals.

Duct leakage to outside is defined as the amount of duct leakage that leaves the building envelope and is tested separately from total duct leakage.

Total duct leakage is defined as the amount of total leakage that leaves the ducts.
Calculate duct leakage using the following formula:

\[
\text{Duct Leakage} = \frac{\text{cfm}_{25}}{\text{square foot of floor area served}}
\]

Where \( \text{cfm}_{25} \) is the volume of air in cubic feet per minute moved through the duct blaster fan to maintain a 25 Pa pressure difference between inside and outside of ductwork. Total duct leakage is the percentage of duct leakage for the entire duct system including the air handler, regardless of duct location.

**Clarifications**
Both the leakage to the outside and the total leakage duct tests apply to all HVAC systems, even those fully inside the building envelope of the home.

Floor area must equal conditioned floor area used for the confirmed HERS energy model.

Rough-in test results may not be used to satisfy this requirement.
Example
A duct system that serves 2,000 sq ft of living space and has a total duct leakage at a 25 Pascal pressure difference of 240 cfm would have a duct leakage of 12%.

\[
12\% \text{ leakage} = \frac{240 \text{ cfm}_{25}}{2000 \text{ sq ft}}
\]

Confirmation
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

ES 3.1 Test duct leakage based on floor area served

Criteria
1. **Leakage to outside \(\leq 2\%\)**
   Duct leakage test result for leakage to outside for each HVAC system is equal to or less than 2% of floor area served.

2. **Total leakage \(\leq 4\%\)**
   Duct leakage test result for total leakage for each HVAC system is equal to or less than 4% of floor area served.

Clarifications
- Both the leakage to the outside and the total leakage duct tests apply to all HVAC systems, even those fully inside the building envelope of the home.
- Floor area must equal conditioned floor area used for the confirmed HERS energy model.
- Leakage rates are specific to each air handler and duct system and may not be averaged when a home has multiple systems.
- Rough-in test results may not be used to satisfy this requirement.

Confirmation
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

Ventilation

ES 4.0 Vent all bathroom exhaust fans and all dryer vents to outdoors; all bathrooms must have exhaust fans

Criteria
- Install exhaust fans in all bathrooms. Vent all bathroom exhaust fans and all dryer vents to outdoors.

Clarifications
- Any room with at least two of the following fixtures is considered a bathroom: sink, toilet, shower, tub or urinal.

Exemptions
- For electric condensing dryers, plumb condensate to a drain according to manufacturer instructions.
ES 4.1 Bath fans with rated airflow of 80 CFM or measured airflow within 10% of rated airflow

Criteria
All bathroom ventilation fans must be rated for airflow ≥80 CFM or be third-party field tested for installed airflow within 10% of rated airflow.

Confirmation
- Rated airflow fan (testing not required)
  - The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
  - The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
- Third party testing
  - The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

ES 4.2 Vent kitchen exhaust fan to exterior with ≥100 CFM: gas ranges and cooktops

Criteria
For each gas range and cooktop, install a kitchen exhaust fan (e.g., kitchen range or downdraft hood) and vent directly to the outdoors.

Kitchen exhaust fans must meet ASHRAE 62.2 section 5 requirements. If exhausting continuously, fan must exhaust greater than 5 ACH, based on kitchen volume, if controlled by occupant to exhaust intermittently, fan must exhaust at least 100 cfm.

To ensure the installed fan exhausts the correct amount of cfm, kitchen exhaust fans must either be rated at a higher airflow than 100 cfm (minimum of 130 cfm on high setting) or have an installed measured airflow verified by a third-party ≥100 cfm and within 15% of the design rate.

Clarifications
Intentional make-up air must be provided for any kitchen vent fan rated at greater than 150 cfm so that total exhaust flow (makeup airflow minus fan rated exhaust) is no greater than 150 cfm.

Confirmation
- Rated airflow fan (testing not required)
  - The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
  - The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
- Third party testing
  - The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.
ES 4.3 Back draft dampers for kitchen, bathroom and dryer exhausts

Criteria
Install back-draft dampers for all exhaust fans.

Clarifications
Common exhausts may not be shared by fans in separate dwelling units (e.g., townhomes).

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

ES 4.4 Install intermittent or continuous ventilation system with damper or labeled controls meeting ASHRAE 62.2-2007 ventilation requirements or Building Science Standard 01-2013 ventilation requirements; exhaust-only ventilation is not allowed

Criteria
Install outside air intake with ventilation CFM, damper and controls meeting ASHRAE 62.2-2007 mechanical ventilation requirements or Building Science Corporation Standard 01-2013. This includes the ventilation system type, location, design rate, and frequency and duration of each ventilation cycle. Exhaust-only ventilation is not allowed.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

Clarifications
Floor area must equal conditioned floor area used for the confirmed HERS energy model.

Ventilation system must be mechanical.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

ES 4.5 Locate all air intakes

Criteria

1. ≥10’ away from exhaust outlets and vehicle idling zones
Locate air intakes for all building systems at least 10 feet away from any exhaust outlets, the driveway and garage, and other areas where vehicle exhaust may be present. Air intake must pull air directly from outdoors and not from adjacent dwelling units, garages, unconditioned crawlspaces or attics.

2. Above grade or roof deck: Climate Zone 2/3 ≥2’, Climate Zone 4 ≥4’
Locate air intakes for all building systems at least 2 feet above grade or roof deck in Climate Zones 2-3 and 4’ above grade in Climate Zone 4.
Clarifications
Air intakes include intakes for closed-system combustion equipment, and outdoor ventilation air supply, etc., and exhaust outlets include bathroom exhaust fans, range hood exhaust fan outlet, dryer exhaust, combustion exhaust, radon vent, etc.

Design air intake locations to minimize obstruction with snow, plantings, condensing units or other material.

Only air intakes used specifically for combustion air are permitted on rooftops.

Ventilation inlet screens can become clogged with debris overtime, therefore EarthCraft recommends, but does not require, builders locate inlets to facilitate access and regular service by the homeowner.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

### ES 4.6 No power roof vents

**Criteria**
Do not install electrically-powered or solar-powered attic exhaust vents.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

### ES 4.7 If installed, ceiling fans must be ENERGY STAR qualified

**Criteria**
If installed, all ceiling fans must be ENERGY STAR qualified.

**Clarifications**
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at:  http://www.energystar.gov

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

### ES 4.8 ENERGY STAR bath fans (all bath fans)

**Criteria**
All bathroom ventilation fans must be ENERGY STAR qualified.

**Clarifications**
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at:  http://www.energystar.gov
Exemptions
Multi-port fans exhausting multiple bathrooms and bath fans with a flow rate greater than or equal to 500 cfm also qualify as meeting this criteria.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at predrywall and final inspections.

ES 4.9 Vent kitchen exhaust fans to exterior ≥100 cfm: electric ranges and electric cooktops

Criteria
For each electric range and cooktop, install a kitchen exhaust fan (e.g., kitchen range or downdraft hood) and vent directly to the outdoors.

Kitchen exhaust fans must meet ASHRAE 62.2 section 5 requirements. If exhausting continuously, fan must exhaust greater than 5 ACH, based on kitchen volume, if controlled by occupant to exhaust intermittently, fan must exhaust at least 100 cfm.

To ensure the installed fan exhausts the correct amount of cfm, kitchen exhaust fans must either be rated at a higher airflow than 100 cfm (minimum of 130 cfm on high setting) or have an installed measured airflow verified by a third-party ≥100 cfm and within 15% of the design rate.

Clarifications
Intentional make-up air must be provided for any kitchen vent fan rated at greater than 150 cfm so that total exhaust flow (makeup airflow minus fan rated exhaust) is no greater than 150 cfm.

Confirmation
Measured airflow fan (testing not required)
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

OR

Third party testing
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

ES 4.10 Verify outdoor air supply ventilation airflow test within 20% of design values

Criteria
Measure ventilation rates to be within 100-120% of design rate.

Confirmation
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.
ES 4.11 Install and label accessible ventilation controls, with override controls for continuously operating ventilation fans

Criteria
Label ventilation controls unless function is obvious (e.g., bathroom exhaust fan).

Clarifications
Include readily accessible override controls for continuously-operating ventilation and exhaust fans (e.g., ERVs and other outdoor air supply ventilation systems).

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

ES 4.12 Duct all bath fans with rigid ducts

Criteria
Duct all bath fans with rigid duct material and seal connections with mastic or mastic tape.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

ES 4.13 Automatic bathroom exhaust fan controls

Criteria
Install either a timer, occupancy sensor or humidity control (i.e., a humidistat) for all bath fans installed in rooms with tubs, showers or similar sources of moisture. Include instructions for using controls in homeowner manual.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

ES 4.14 Energy recovery ventilator

Criteria
Install an Energy Recovery Ventilator (ERV) according to the manufacturer’s specifications and meeting ASHRAE 62.2-2007.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

ES 4.15 Vent attached storage rooms to outside

Criteria
Provide a separate storage room in the garage with a lockable door vented directly to the outdoors with a minimum of 100 sq in of net free vent area per 100 sq ft of floor area.
**Clarifications**

No combustion equipment or HVAC equipment may be installed in the storage room.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

---

**Water Heater**

**ES 5.0 Heat trap on storage water heater**

**Criteria**

If installing storage water heater, either purchase storage water heater with heat trap installed or install heat trap on storage water heater.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**ES 5.1 High efficiency water heater**

**Criteria**

Install high efficiency storage water heater that meets the energy factor (EF) requirements in the following table for gas or electric operation:

<table>
<thead>
<tr>
<th>Gallons</th>
<th>Gas</th>
<th>Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 30</td>
<td>0.63</td>
<td>0.94</td>
</tr>
<tr>
<td>B. 40</td>
<td>0.61</td>
<td>0.93</td>
</tr>
<tr>
<td>C. 50</td>
<td>0.59</td>
<td>0.92</td>
</tr>
<tr>
<td>D. 60</td>
<td>0.57</td>
<td>0.90</td>
</tr>
<tr>
<td>E. 70</td>
<td>0.55</td>
<td>0.90</td>
</tr>
<tr>
<td>F. 80</td>
<td>0.53</td>
<td>0.89</td>
</tr>
</tbody>
</table>

**G. Tankless water heater**

Install a tankless gas water heater according to manufacturer specifications that meets a minimum of 0.69 energy factor for gas or 0.97 energy factor for electric.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

**ES 5.2 Hot water piping insulation ≥R-4 (100%)**

**Criteria**

Insulate all hot water pipes to R-4 or greater using polyethylene, neoprene, fiberglass or other insulation types. Fit insulation tightly around hot water pipe, face seam down and
secure insulation every 2 feet using wire, tape or clamp. Install insulation on all piping elbows to adequately insulate 90-degree bend.

**Exemptions**
Hydronic heating systems are not required to insulate pipes in slabs or other approved materials intended for radiating heat into home and therefore do not apply to this criteria.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

### ES 5.3 ENERGY STAR qualified heat pump water heater

**Criteria**

**ENERGY STAR qualified heat pump**
Install ENERGY STAR heat pump water heater with a minimum Energy Factor of 2.0 and according to manufacturer’s specifications.

**Clarifications**
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at: http://www.energystar.gov.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

### Lighting and Appliances

### ES 6.0 ENERGY STAR Advanced Lighting Package

**Criteria**
Design and construct home in accordance to ENERGY STAR Advanced Lighting Package. A minimum of 60% ENERGY STAR qualified hard-wired fixtures (both indoor and outdoor).

**Clarifications**
ENERGY STAR qualified recessed light fixtures, ceiling fan light kits and ventilation fans with lighting can be counted toward the fixture requirement.

All installed ceiling fans must be ENERGY STAR qualified.

As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

**Additional Resources**
A list of qualified products can be found at: http://www.energystar.gov.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
ES 6.1 High-efficacy lighting in ≥80% of all permanent indoor and outdoor fixtures

Criteria
Install high-efficacy lighting in 80% or more of all permanent fixtures. High efficacy lighting includes compact fluorescent bulbs, LED bulbs, T-8 or smaller diameter linear fluorescent bulbs, or bulbs with a minimum efficacy of:

- 60 lumens per watt for bulbs over 40 watts
- 50 lumens per watt for bulbs from 15 watts to 40 watts
- 40 lumens per watt for bulbs 15 watts or less

Example
3 bedroom, 3 bathroom home has the following permanent lighting fixtures:

- Kitchen: five can lights, one 2-bulb fixture = 6 fixtures and 7 bulbs
- Laundry: one 2-bulb fixture = 1 fixture and 2 bulbs
- Hallways: two 2-bulb fixtures = 2 fixtures and 4 bulbs
- Closets: five one-bulb fixtures = 5 fixtures and 5 bulbs
- Bedrooms: three 3-bulb fixtures = 3 fixtures and 9 bulbs
- Bathrooms: four 3-bulb fixtures, three 1-bulb fixtures = 7 fixtures and 15 bulbs
- Living Room: one 4-bulb fixture and 2 can lights = 3 fixtures and 6 bulbs
- Dining Room: one 8-bulb fixture = 1 fixture and 8 bulbs
- Garage: two 2-bulb fixtures = 2 fixtures and 4 bulbs

Home TOTAL: 30 fixtures and 60 bulbs

At least 30 bulbs in the home must be high efficacy.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

ES 6.2 If installed, ENERGY STAR qualified dishwasher

Criteria
All installed dishwashers must be ENERGY STAR qualified.

Clarifications
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

Additional Resources
A list of qualified products can be found at: http://www.energystar.gov

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.
ES 6.3 If installed, ENERGY STAR qualified refrigerator

Criteria
All installed refrigerators must be ENERGY STAR qualified.

Clarifications
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

Additional Resources
A list of qualified products can be found at: http://www.energystar.gov

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

ES 6.3 If installed, ENERGY STAR qualified clothes washer (water factor ≤6.0 gal)

Criteria
All installed clothes washers must be ENERGY STAR qualified with a water factor of less than or equal to 6.0 gallons.

Clarifications
As products and ENERGY STAR qualifications are periodically updated, the product must be on the list of ENERGY STAR qualified products at the time it was purchased.

Additional Resources
A list of qualified products can be found at: http://www.energystar.gov.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

ES 6.5 Lighting control systems

Criteria
1. **Automatic outdoor lighting controls**
Control exterior lighting with automatic motion or timer controls that incorporate a photocell to prevent daytime use.

2. **Garage lighting use a timer switch or occupancy sensor**
Install either a timer switch or an auto-on and auto-off occupancy sensor for garage lighting.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
Water Efficiency

Conserving our finite fresh water resources has become vitally important in both protecting our environment and helping sustain economic growth in our region. The use of certain strategies like water-efficient fixtures, water-efficient landscaping and irrigation, and reusing water on-site through rainwater or gray water systems can significantly reduce a residents water consumption as well as their utility bills.

The Water Conservation category emphasizes the efficient use of potable water indoors and outdoors. An EarthCraft project aims to reduce water waste and storm water run-off. Strategies include drought adapted landscaping, improved plumbing distributions systems and efficient plumbing fixtures.

Indoor Water Use

WE 1.0 Detect no leaks at any water-using fixture, appliance or equipment

Criteria
There must be no detected leaks from any water-using fixture, appliance or equipment as determined by pressure-loss testing and visual inspections.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

WE 1.1 WaterSense labeled toilets, showerheads, lavatory faucets and accessories (all must comply)

Criteria

WaterSense labeled toilet (≤1.28 avg. gal/flush)
All installed toilets must have a maximum gallon per flush of 1.28 or less and be WaterSense labeled.

WaterSense labeled lavatory faucet and accessories (≤1.5 gpm)
All installed bathroom sink faucets and accessories must have a maximum flow rate of 1.5 gallons per minute or less and be WaterSense labeled.

WaterSense Showerheads (≤2.0 gpm)
All installed showerheads must have a maximum flow rate of 2.0 gallons per minute or less and be WaterSense labeled.

Additional Resources
A list of WaterSense labeled fixtures can be found at: www.epa.gov/watersense.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria at final inspection.
WE 1.2 WaterSense New Home Certification

Criteria
To label a home as WaterSense New Home, the builder must sign WaterSense partnership agreement, build home to WaterSense specifications, submit home for inspection by a certified WaterSense Inspector and pass inspection. Complete WaterSense Labeled New Home Inspection Checklist.

Include the following in the project-specific owner’s manual:

- Information for all water-using equipment or controls installed and relevant WaterSense materials on indoor and outdoor water use.
- If installed, a record drawing (schematic) of the irrigation system, an itemized list of irrigation components, copies of irrigation schedules and information about reprogramming the irrigation schedule after the establishment of the landscape.
- General information on water-efficient appliances.

Additional Resources
Version 1.2 of the EPA WaterSense New Home Certification System PDF can be found at: www.epa.gov/WaterSense/docs/final_certification_system508.pdf

WE 1.3 Kitchen sink faucet and accessories (≤2.0 gpm)

Criteria
All installed kitchen sink faucets and accessories must have a maximum flow rate of 2.0 gallons per minute.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

WE 1.4 Store ≤0.5 gal of water between water heater and fixture

Criteria
The hot water distribution system must store no more than 0.5 gallons of water in any piping/manifold between the hot water source and any hot water fixture.

To account for the additional water that must be removed from the system before hot water can be delivered, no more than 0.6 gallons of water must be collected from the hot water fixture before hot (105°F) water is delivered.

Clarifications
If a circulation system is used, to must be on-demand circulation. Continuous circulation systems and circulation systems with timers are not an approved method.

Builders are encouraged to design systems to store less than 0.35 gallons of water in any piping/manifold between the hot water source and any hot water fixture to ensure no more than 0.6 gallons of water are collected from the hot water fixture before hot water is delivered.
MAXIMUM LENGTH OF PIPE OR TUBE

<table>
<thead>
<tr>
<th>Nominal Pipe or Tube Size (inch)</th>
<th>Liquid Ounces per Foot of Length</th>
<th>Maximum Pipe or Tube Length System without a Circulation Loop or Heat Traced Line (feet)</th>
<th>Maximum Pipe or Tube Length System with a Circulation Loop or Heat Traced Line (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4a</td>
<td>0.33</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>5/16a</td>
<td>0.5</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>3/8a</td>
<td>0.75</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>1/2</td>
<td>1.5</td>
<td>43</td>
<td>16</td>
</tr>
<tr>
<td>5/8</td>
<td>2</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>3/4</td>
<td>4</td>
<td>21</td>
<td>8</td>
</tr>
<tr>
<td>7/8</td>
<td>5</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>1 1/4</td>
<td>8</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>1 1/2</td>
<td>11</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>2 or larger</td>
<td>18</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

a. The flow rate for 1/4 inch size is limited to 0.5 gpm; for 5/16 inch size is limited to 1 gpm; for 3/8 inch size is limited to 1.5 gpm.

Table provided by Gary Klein

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall inspection and test compliance at final inspection.

**WE 1.5 Toilet (≤1.1 avg gal/flush)**

**Criteria**
All installed toilets must have an average maximum gallon per flush of 1.1 or less.

**Clarifications**
Dual flush toilet average flush rates shall be calculated as follows: (2 low flush + 1 high flush)/3.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**Outdoor Use**

**WE 2.0 Cover all exposed soil with 2"-3’’ mulch layer**

**Criteria**
Install mulch to cover planting beds with at least 2 inches but no more than 3 inches of mulch during landscaping installation.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
WE 2.1 If installed, irrigation system

Criteria

1. **Must have rain sensor shutoff switch**
Irrigation systems must be equipped with technology (either a rain sensor or soil moisture sensor) that inhibits or interrupts operation of the irrigation system during periods of rainfall or sufficient soil moisture.

2. **Provide operating manual to homeowner**
The builder must develop and provide to the homeowner a written operating and maintenance manual for all water-using equipment or controls installed in the house or yard, including all relevant WaterSense materials on indoor and outdoor water use. This may be a chapter or folder in an existing manual.

3. **Provide irrigation system layout to homeowner**
The builder must provide irrigation system layout to homeowner.

4. **Does not water hard surfaces such as sidewalks and home foundation**
Irrigation system does not water impermeable surfaces.

<table>
<thead>
<tr>
<th>Confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rain sensor shutoff switch</strong></td>
</tr>
<tr>
<td>- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the final inspection.</td>
</tr>
<tr>
<td><strong>Manual</strong></td>
</tr>
<tr>
<td>- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.</td>
</tr>
<tr>
<td>- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.</td>
</tr>
<tr>
<td><strong>Irrigation system layout to homeowner</strong></td>
</tr>
<tr>
<td>- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.</td>
</tr>
<tr>
<td>- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.</td>
</tr>
<tr>
<td><strong>Hard surfaces</strong></td>
</tr>
<tr>
<td>- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the final inspection.</td>
</tr>
</tbody>
</table>

WE 2.2 If installed, all pools or spas must have an appropriate cover

Criteria

Any installed pools or spas must have an appropriate cover that reduces heat loss and evapotranspiration.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

<table>
<thead>
<tr>
<th>Confirmation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.</td>
</tr>
</tbody>
</table>
WE 2.3 If installed, ornamental water features must recirculate water and serve beneficial use

Criteria
Install ornamental water feature that recirculates water from the feature itself and serve a beneficial use.

Provide information on type of system, maintenance, and monitoring requirements in project-specific owner’s manual.

Clarifications
Beneficial uses include wildlife habitat, stormwater management and/or noise reduction.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

WE 2.4 Irrigation

Criteria
1. Zone irrigation system for specific water needs in each planting area
Design irrigation system with zones based on water needs in each planting area. Attention should be given to the sprinklers at the tops and bottoms of sloped areas to prevent runoff. Micro-irrigation shall be installed on separate zones from the rest of the irrigation system if sprinkler heads are used in other parts of the landscape.

2. Provide weather station or soil moisture sensor on irrigation system
Equip irrigation systems with technology that inhibits or interrupts operation of the irrigation system during periods of rainfall or sufficient moisture (e.g., rain sensors, soil moisture sensors).

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

WE 2.5 Test and amend soil

Criteria
Test soil using a soil testing kit from the local cooperative extension office or other reliable source such as a garden supply store. Till and amend soil as needed to provide the appropriate balance of nutrients, pH, organic material content and percolation based on designed landscape. Till soil 3-6 inches deep.

Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
WE 2.6 Landscape

Criteria

A. Turf ≤40% of landscaped area
Install turf grass on 40% or less of the landscaped area.

B. Drought-tolerant/native landscaping turf and plants (≥75%)
Install 75% or more drought-tolerant/native landscaping turf and plants.

Additional Resources
A list of drought-tolerant/native landscaping turf and plants may be obtained through a local cooperative extension office.

Confirmation
- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the final inspection.

WE 2.7 Vegetate slopes

Criteria
Install erosion resistant vegetation on all slopes greater than 4 feet of horizontal run per 1 foot vertical rise, or provide terracing.

Example
Trees, shrubs, taller growing grasses and wildflowers can be effective plantings for preventing erosion.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

WE 2.8 If installed, irrigation system is:

Criteria

1. Micro-irrigation system (e.g., drip irrigation) includes pressure regulator, filter and flush end assemblies
If installed, micro-irrigation system (a low-pressure irrigation system that sprays, mists, sprinkles or drips) includes a pressure regulator, filter and flush end assemblies.

2. Distribution uniformity ≥65% lower quarter
Irrigation systems must achieve lower quarter distribution uniformity (DUₐ) of 65 percent or greater. Measure the distribution uniformity on the largest spray-irrigated area during the post-installation audit.

3. Install sprinklers only on turf grass, pop-up height ≥4"
Install sprinkler heads so that the heads have a 4” or greater pop-up height, matched precipitation nozzles and check valves. Use sprinkler irrigation on turfgrass only, on strips 4’ wide or greater, and slopes less than or equal to 4:1.
4. Establish grow-in phase and post landscape seasonal water schedules at irrigation controller

Establish grow-in phase and post landscape seasonal water schedules at irrigation controller

Post two watering schedules developed by the WaterSense irrigation controller at the irrigation controller. The first schedule must address the initial grow-in phase of the landscape and the second schedule must address the established landscape. Both schedules must vary according to the season.

Exemptions

Waivers from this requirement may be available if there are an insufficient number of available WaterSense irrigation partners proximate to the project site.

Definitions

Distribution uniformity is the measure of uniformity of applied irrigation water over an area. DU_LQ is the ratio of the average of the lowest 25 percent of measurements to the overall average measurement.

Additional Resources

A list of WaterSense irrigation partners is available at: www.epa.gov/watersense/meet_our_partners.html.

Auditing procedures are described in the Irrigation Audit Guidelines for WaterSense Labeled New Homes at: www.epa.gov/watersense/nhspecs/cert_new_homes.html.

**Confirmation**

- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**WE 2.9 Alternative irrigation:**

**Criteria**

1. Greywater irrigation system

Install a greywater system for landscape irrigation. The system must be approved by local building and/or health department, include a tank or dosing basin and collect water from a minimum of the clothes washer or shower.

2. Rainwater irrigation system

Design and install a rainwater harvesting and storage system for landscape irrigation. Size the storage system to hold water from a 1” rainfall event (0.62 gallons per square foot) from 50% or greater of the total roof area of the home.

**Clarifications**

For multifamily projects, water captured from HVAC condensate drain may be used to meet the intent of #2 listed above.
Confirmation
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

WE 2.10 Install rain barrel (≥150 gallon capacity) with hose bib

Criteria
Install rain barrel with a capacity of 150 gallons or greater with a hose bib. Supply rain barrel with water by connecting it to at least one downspout connection. Locate rain barrel close to area of landscape that is watered frequently.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
Education and Operations

Education

The best designed and constructed home can still be inefficient if the resident does not utilize its high performance benefits properly. The Education and Operations category provides strategies for informing the homebuyer or resident of the benefits of an EarthCraft house as well as how to best use energy efficient features to maximize efficiency. Improved homeowner education may lead to fewer comfort complaints and call backs in green homes.

EO 1.0 Provide homeowner with project-specific owner’s manual

Criteria

Provide homeowner with project-specific owner’s manual. Manual must contain, at a minimum, the following information:

- General
  - The final EarthCraft Worksheet for the home with cover sheet, and a copy of the EarthCraft certificate for the home.
- Energy Efficient Systems
  - Instructions for the proper use and maintenance of all energy-using systems, including, but not limited to:
    - Exhaust fans (kitchen range, bath, etc.)
    - Fireplaces
    - HVAC systems including filters, whole-house ventilation and thermostats
    - Water heaters
- Education and Operations
  - Provide at least three additional green activities such as recycling, proper management of hazardous waste disposal, gardening, the use of healthy cleaning materials, alternative measures to pest control, neighborhood conveniences to facilitate a healthy lifestyle and the purchase of green power.
  - Recycling information must include recycling facilities conveniently located to the home as well as a list of haulers that provide curbside service.
- Credit Specific Items requiring operating manuals/instructions:
  - DU 1.8 Alternative termite treatment with no soil pretreatment
  - BE 3.6 If installed, whole house fan has sealed, insulated cover ≥R-19
  - ES 4.4 Install intermittent or continuous ventilation system with damper or labeled controls meeting ASHRAE 62.2-2007 ventilation requirements or Building Science Standard 01-2013 ventilation requirements; exhaust-only ventilation is not allowed
  - ES 4.13 Automatic bathroom exhaust fan controls
  - WE 2.4 Irrigation
  - INN EO 1.0 Install backyard composting bin
  - WE 1.2 WaterSense New Home Certification
• IAQ 2.5  Indoor airPLUS

- Credit Specific Items requiring warranty information:
  • INN DU 1.3.1  Exterior cladding (≥3 sides) with 40-year warranty
  • INN DU 1.4  Windows, doors and skylights with ≥ 25-year warranty
  • DU 1.10 Roofing warranty ≥40 year warranty
  • DU 1.11 Outdoor deck material (≥25 year warranty)

Clarifications
Equipment manuals are acceptable, but shall be supplemented with clear and specific instructions to the homeowner on when and how equipment shall be used.

Detailed information on credit specific items is located under that line item in the guidelines.

Additional Resources

For templates of guides that not only list the environmental features of the homes but also explain their intent, benefits and maintenance, see: http://www.greencommunitiesonline.org/tools/resources/.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

EO 1.1 EarthCraft House Certified Builder

Criteria
Home must be constructed by an EarthCraft House Certified Builder in good standing and be registered with EarthCraft prior to the pre-drywall inspection.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.
Operations and Management

Incorporating high performance measures and green construction technologies requires the review of all operations, not just construction practices, for evaluation of sustainability. The builders that integrate green business strategies into their entire company operations may have the greatest success in market transformation.

Although the EarthCraft program’s main goal is to reduce the environmental impact of the homes certified under the program, the program as an additional goal of encouraging EarthCraft Builders to minimize the negative environmental impacts of all of their projects. For example, EarthCraft Builders can earn points in the Operations and Management category by providing environmental checklists to all subcontractors or by committing to build at least 80% of their projects to EarthCraft standards.

EO 2.0 Install built-in recycling center

Criteria
Provide site-built or commercially manufactured recycling containers for at least three materials (e.g., paper, aluminum, plastic, glass, etc.).

Clarifications
One container is acceptable where the municipality offers single-stream (fully-commingled) recycling.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

EO 2.1 Provide all subcontractors with EarthCraft House worksheet

Criteria
Provide and review the relevant EarthCraft House measures with each subcontractor to ensure their compliance with the program guidelines.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance of criteria with the builder at the pre-drywall and final inspections.

EO 2.2 Build and certify percentage of homes annually as EarthCraft House

Criteria

1. 50%
Commit to building and certifying a minimum of 50% of total houses to EarthCraft House standards within the upcoming twelve month period.

2. 100%
Commit to building and certifying a minimum of 100% of total houses to EarthCraft House standards within the upcoming twelve month period.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance of criteria with the builder at the final inspection.
EO 2.3 Market EarthCraft House program

Criteria
Include EarthCraft House logo in all print materials, websites, advertisements and other promotional materials associated with project promotion.
Post an EarthCraft House sign in front yard of home during construction.

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EO 2.4 Certified Professional Home Builder

Criteria
The builder must be a Certified Professional Home Builder or approved equivalent such as Graduate Master Builder administered by the National Association of Home Builders.

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EO 2.6 Certified EarthCraft HVAC Trade Contractor

Criteria
HVAC system installation by a Certified EarthCraft House HVAC Trade Contractor.

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EO 2.7 EarthCraft Real Estate Professional

Criteria
Home is listed or sold by a Certified EarthCraft Real Estate Professional.

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Innovation

EarthCraft strives to advance market transformation towards green and high-performance building construction in the Southeast. While the program is comprehensive in scope, new products, technologies and strategies are continuing to be developed supporting the mission of EarthCraft and EarthCraft Builders. The Innovation category is intended to provide builders the opportunity to present new ideas for advancing green home building and reward those implementing cutting edge technologies. Builders are encouraged to present products, technologies and strategies not covered elsewhere within the EarthCraft program and to provide program flexibility for builders achieving exemplary performance in existing EarthCraft strategies.

Site Planning (SP)

INN SP 1.0 Brownfield Site

Criteria
Build home on a brownfield site. A brownfield site is where expansion or re-development is complicated by the real or perceived presence of a hazardous substance, pollutant or contaminant. Brownfield sites are typically located at abandoned, idle or under used industrial or commercial facility.

Construction Waste Management (CW)

INN CW 1.0 Reused, recycled or local cabinet faces and/or cabinets

Criteria
Install cabinets and/or cabinet faces made from reused, recycled or local content.

Recycled content must be 25% post-consumer or 50% post-industrial for 90% of the material by weight or volume.

Local content must be 90% of the material by weight or volume extracted, processed and manufactured within 500 miles of the project site.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

INN CW 1.1 Reclaimed wood flooring (≥20% of total floor area)

Criteria
Install reclaimed wood flooring on ≥20% of floor area.

Clarifications
Floor area must equal conditioned floor area used for the confirmed HERS energy model.
Confirmation

The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.

The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

Resource Efficiency (RE)

INN RE 1.0 Modular construction for entire house

Criteria
Construct above grade sections off site and deliver in modules to the site.

Clarifications
Projects constructing sections on site, such as chimneys, do not qualify for this credit. Only the foundation and porch may be site constructed.

Confirmation
The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

INN RE 1.1 Total floor area of house:

Criteria

1. <1,500 sq ft
   The total conditioned floor area of the house is less than 1,500 sq ft.

2. 1,500-1,799 sq ft
   The total conditioned floor area of the house is between 1,500 and 1,799 sq ft.

3. 1,800-2,100 sq ft
   The total conditioned floor area of the house is between 1,800 and 2,100 sq ft.

Clarifications
Floor area must equal conditioned floor area used for the confirmed HERS energy model.

Confirmation
The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.
INN RE 1.2 Outside dimensions of floor plan adheres to 2’ dimensions

Criteria
Design building length, width and roof pitch using 2’ increments to maximize use of common sheet good sizes and minimize cut-off waste.

![Sample home plan adhering to 2’ dimensions](image)

Figure 75: Sample home plan adhering to 2’ dimensions

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall and final inspections.

INN RE 1.3 Use recycled concrete or alternate material as aggregate in foundation

Criteria
At least 30% of coarse aggregate or 10% of fine aggregate in poured concrete structures must be from demolished concrete or alternative material (e.g., crushed porcelain).
Innovation

Confirmation
• The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
• The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

INN RE 1.4 Exterior cladding and trim (≥25% recycled content material)

Criteria
Installation of exterior cladding and trim with ≥25% recycled content material (pre or post-consumer, excluding fly ash) content by weight or volume.

Clarifications
Recycled fly ash may not be counted under this criterion, but rather under RE 3.2.

Additional Resources
For more information about SCS-certified recycled content products see www.scscertified.com.

INN RE 1.5 Flooring:

Criteria
1. Cork, natural linoleum, sealed concrete or bamboo flooring (≥20% of total floor area)
Install cork, natural linoleum, sealed concrete or bamboo flooring on ≥20% of total floor area. Bamboo flooring must be sustainably harvested.

2. Recycled content tiles (≥30% recycled content material on 100% of tile floor area)
Install tile with ≥30% recycled content on 100% of tile floor area.

3. Carpet (≥50% recycled content material on ≥50% of all carpeted floor area)
Install carpet with ≥50% recycled content (pre or post-consumer) on 50% of carpet floor area.

Clarifications
Floor area must equal conditioned floor area used for the confirmed HERS energy model.

Additional Resources
For more information about SCS-certified recycled content products see www.scscertified.com.

Confirmation
• The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
• The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.
Durability and Moisture Management (DU)

INN DU 1.0 Insulate cold water pipes ≥R-2

Criteria

Insulate all cold water pipes located inside conditioned spaces and in inaccessible interstitial locations (e.g., in walls, floor cavities, etc.) to ≥R-2 for condensation prevention.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

INN DU 1.1 Covered entryways

Criteria

1. All doors, ≥3’ depth
On all exterior doors, install covered entry way that extends 3’ out from door.

2. Covered and usable front porch, ≥6’ depth
Design home with a covered and useable front porch. Porch must be large enough to accommodate a seating area (minimum of 6’ x10’).

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

INN DU 1.2 Roof drip edge with ≥1/4” overhang

Criteria

Protect the outer edge of all roof decking with a metal or plastic drip edge that has a minimum 1/4” overhang beyond the exterior roofing material.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

INN DU 1.3 Siding:

Criteria

1. Exterior cladding (≥3 sides) with 40-year warranty
Install exterior wall cladding either with a 40-year manufacturer’s warranty or constructed from durable natural material such as masonry, stucco, stone or brick on a minimum of three sides of the building.

2. Back-primed siding and trim
Prime all six sides of painted or stained exterior siding and trim prior to installation.

Confirmation

Exterior cladding with 40-year warranty
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm at pre-drywall inspection.

Back-primed siding and trim
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

## INN DU 1.4 Windows, doors and skylights with ≥25-year warranty

### Criteria
All installed exterior windows, doors and skylights must have ≥25-year manufacturer’s warranty.

### Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

## INN DU 1.5 Paperless drywall in kitchens, baths, and foundation walls

### Criteria
Install paperless drywall in:
- Kitchens on all wet walls (walls with sink, stove, dishwasher, refrigerator and any other high moisture appliance/fixture) extending 4 feet from each edge of the appliance/fixture
- Bathrooms with bathing facilities (e.g. shower/tub) on all walls
- Basements on all foundation concrete walls

### Confirmation
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at final inspection.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

## INN DU 1.6 Drainage board for below grade walls

### Criteria
Install a drainage plane material that channels water down to the footing drain tile for all below-grade walls.

### Clarifications
Wood-framed below-grade walls are not allowed along the exterior of the home.

Do not install Class 1 vapor retarders on the interior side of air permeable insulation in exterior below-grade walls, except for tile at showers and tub walls. Mirrors may be used if they are mounted with clips or other spacers that allow air to circulate behind them.

Additional strategies required to meet this credit intent include but are not limited to:
- BE 1.0 Install vapor barriers only under slabs and on crawlspace floors

**Confirmation**
- The builder will illustrate compliance of criteria through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder for compliance of criteria.

### INN DU 1.7 Capillary break between footing and foundation

**Criteria**
Install plastic to form a capillary break between the ground and the footing or between the footing and foundation. The capillary break must be continuous from the edge of the footing to the slab with an overlapping seam of at least 6”, and integrated in with the foundation wall drainage system.

![Capillary break](image)

**Figure 76: Capillary break between ground and footing**

### INN DU 1.8 Insulate condensate discharge piping ≥R-2

**Criteria**
Insulate all condensate piping in exterior walls and install all condensate discharge according to IRC section M1411.3. In addition, condensate piping must maintain a minimum 1% slope (e.g., not less than 1/8 unit vertical in 12 units horizontal).

**Clarifications**
IRC section M1411.3 states that all condensate discharge must be conveyed to an approved place of disposal (not a street, alley).

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.
Indoor Air Quality (IAQ)

INN IAQ 3.0 Pass BPI or RESNET combustion safety tests if combustion appliances are present

Criteria
Verify the worst case depressurization of the combustion appliance zone (CAZ) does not exceed the CAZ depressurization limits in BPI technical standards or RESNET standards. Verify the spillage, draft, and CO under natural conditions is 25 parts per million (ppm) or below. An independent third-party Building Performance Institute (BPI) Certified Building Analyst must conduct BPI’s combustion safety test procedure, or an independent third-party HERS Rater must conduct RESNET combustion safety test procedure.

Confirmation
- The EarthCraft Technical Advisor will diagnostically test compliance of criteria at the final inspection.

INN IAQ 3.1 No added urea-formaldehyde in all cabinets, shelves, and countertops

Criteria
Do not install cabinetry, shelves and countertops that contain added urea-formaldehyde.

Confirmation

Insulation and Subfloor
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

Cabinets, Shelves, Countertops
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

High Performance Building Envelope (BE)

INN BE 1.0 Insulate basement walls instead of ceiling using continuous insulation: Climate Zone 2/3 ≥R-5, Climate Zone 4 ≥R-10

Criteria
Insulate below-grade basement walls with R-5 or greater continuous insulation in Climate Zones 2 and 3 or R-10 or greater continuous insulation in Climate Zone 4.
INN BE 1.1 Attic kneewall:

Criteria

1. **2x6 with ≥R-19 cavity insulation and ≥R-3 insulated sheathing**

Construct attic kneewalls using 2x6 framing (or 2x4 framing furred out 2”), and install R-19 cavity insulation. Install R-3 rigid insulated sheathing on attic side of framing. Seal top and bottom of attic side sheathing to plates and seal all seams and joints.

![Figure 77: Attic kneewall insulation](image)

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

INN BE 1.2 Insulation installation quality (floors, walls, and ceilings)

Criteria

1. **Grade II with insulated sheathing ≥R-3 (100%)**

Install insulation per manufacturer’s recommendations to achieve quality Grade II as specified by criteria set forth by RESNET. Walls, rim joists and ceilings must also have 100% insulated sheathing ≥R-3. All insulation must meet or exceed Grade II installation quality regardless of location in home.

INN BE 1.3 Slab edge insulation: Climate Zone 2/3 ≥R-4

Criteria

Install exterior slab insulation (Climate Zone 2/3 ≥R-4 (heated slabs ≥R-5) so that it extends to the top of the slab. Slab edge insulation must extend to the bottom of the footing or 2’ whichever is less.
Clarifications
Where an insulated wall separates a garage, patio, porch or other unconditioned space from the conditioned space of the house, slab insulation shall also be installed at this interface to provide a thermal break between the conditioned and unconditioned slab, unless the slab is post-tensioned with integrated garage or porch foundations.

For exterior slab edge insulation, such as for monolithic slabs, install insulation with approved membranes, such as EPDM-type membranes, to protect against termites.

Non-monolithic slabs may use rigid insulation between the stem wall and the poured (floating) slab, using the protective membrane as a termite flashing and as a capillary break.

If the top edge of the insulation is installed between the exterior wall and the edge of the interior slab, it shall be permitted to be cut at a 45-degree angle away from the exterior wall.

Figure 78: Slab edge insulation for floating slab

Confirmation
- The builder will illustrate compliance through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder at pre-drywall.
**INN BE 1.4 Continuous insulation on underside framed floors ≥R-3**

**Criteria**
Install continuous insulation on the underside of insulated framed floors in order to completely encapsulate cavity insulation. Continuous insulation must be R-3 or greater, be in addition to the minimum cavity R-value required for the floor assembly, and must be in contact with cavity insulation. Cavity insulation must completely fill framed floor cavity and be in contact with subfloor and continuous insulation.

**Clarifications**
If insulating a steel joist floor, R-6 continuous insulation must be installed in addition to floor insulation listed above.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

**INN BE 1.5 Insulated wall sheathing:**

**Criteria**

1. **≥R-5 (75%)**
   Install R-5 or greater insulated sheathing on at least 75% of exterior walls. Install sheathing to have no gaps greater than 1/4” and provide complete coverage except where structural sheathing is required by code (maximum of 25%).

2. **≥R-5 (100%)**
   Install R-5 or greater insulated sheathing on all exterior walls. Install sheathing to have no gaps greater than 1/4” and provide complete coverage. Where structural sheathing is required by code, install a structurally rated insulated sheathing or over-sheath using insulated sheathing.

**Confirmation**
- The builder will illustrate compliance through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- The EarthCraft Technical Advisor will review photo documentation provided by the builder at pre-drywall.

**INN BE 1.6 Insulated roofline attic to create unvented attic ≥R-19**

**Criteria**

1. **Install SIP roof**
   Install structural insulated panel (SIP) roof to create an unvented attic ≥R-19.

2. **Air permeable insulation plus rigid foam insulation (Climate Zone 2/3 ≥R-5, Climate Zone 4 ≥R-15) in contact with roof decking**
   Insulate roofline of attic using air permeable insulation ≥R-19 plus rigid foam insulation to create unvented roofline. Rigid foam insulation, Climate Zone 2/3 ≥R-5, Climate Zone 4 ≥R-15, must be in direct contact with roof decking by being installed either directly above or directly below the roof decking.
Clarifications

Ridge, soffit, gable or other attic ventilation is prohibited.

Combustion appliances installed in attic must be direct vent or sealed combustion.

Manufacturer recommended installation procedures and ignition barrier code requirements must be followed.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall and final inspections.

INN BE 1.7 Skylight U-factor and SHGC:

Criteria

1. **U-factor**: Climate Zone 2 ≤ 0.55, Climate Zone 3 ≤ 0.45, Climate Zone 4 ≤ 0.43
   
   All skylights in Climate Zone 2 must have a U-factor less than or equal to 0.55.
   
   All skylights in Climate Zone 3 must have a U-factor less than or equal to 0.45.
   
   All skylights in Climate Zone 4 must have a U-factor less than or equal to 0.43.

2. **SHGC**: Climate Zone 2/3/4 ≤ 0.24
   
   All windows in Climate Zones 2, 3, and 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.24.
**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

**INN BE 1.8 Glazing facing:**

**Criteria**

1. **West facing glazing ≤ 2% of floor area**
   The total window or door glazing area within 25 degrees of due west must be less than or equal to 2% of the total conditioned floor area.

2. **East facing glazing ≤ 3% of floor area**
   The total window or door glazing area within 25 degrees of due east must be less than or equal to 3% of the total conditioned floor area.

**Clarifications**
Floor area must equal conditioned floor area used for the confirmed HERS energy model.

**Example**
A home with total conditioned floor area of 2,000 square feet may not have more than 60 sq ft of window and door glazing area within 25 degrees of due west.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and visually confirm at final inspection.

**INN BE 1.9 1.5’ overhangs over ≥ 80% of south-facing windows**

**Criteria**
Maintain a 1.5’ overhangs on 80% of all south-facing window area to protect against moisture and summer solar gain. Maximum overhang height above window is 2’.

**Clarifications**
Installed gutters may not contribute to the 1.5’ distance.
Additional Resources
For an overhang design tool to analyze the shading performance of an overhang see www.susdesign.com/overhang/index.php.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

INN BE 1.10 Certified passive solar design (25% load reduction)

Criteria
Certified passive solar heating contribution reduces the total heating loads by 25% or greater and does not increase cooling loads by more than 10%. Certification must be based on Energy 10 or similar EarthCraft approved modeling program.

Clarifications
EarthCraft window requirements do not need to be met if windows are facing within 15 degrees of true south and directly coupled to a thermal storage mass that has a heat capacity \( \geq 20 \) Btu/ft\(^3\) x \(^\circ\) F and provided in a ratio of at least 3 sq ft per sq ft of south facing fenestration. For the required heat capacity, thermal masses typically must be at least 2” thick. Code compliance must be demonstrated using modeling software.

Additional resources:
For additional information on Energy 10, go to www.sbicouncil.org.
Figure 81: Seasonal solar position

**Confirmation**
- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria.

### INN BE 1.11 Install green roof system (≥30% of total roof area on lot)

**Criteria**
Install a green roof system on 30% or greater of the total roof area on the lot in order to manage storm water runoff, provide additional insulation and combat the heat island effect.

**Example**
A roof partially or completely covered by vegetation on top of a growing medium and a waterproof membrane.

**Confirmation**
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.
INN BE 1.12 Type of water heater:

Criteria

1. **Solar domestic (≥40% of annual load)**
   Install a solar domestic water heater according to manufacturer specifications to handle a minimum of 40% of the annual water-heating load.

2. **High efficiency tankless water heater with insulated buffer tank**
   Install a tankless gas water heater according to manufacturer specifications that meets a minimum of 0.69 energy factor for gas or 0.97 energy factor for electric with an insulated buffer tank to reduce water wasted while tankless water heater ramps up to desired hot water temperature.

   OR

   Install heat recovery water heating (refrigerant-to-water de-superheating coil) according to manufacturer specifications to recover waste heat from an air conditioner or heat pump to heat domestic water.

INN BE 1.13 Exterior walls ICF

Criteria

Construct a minimum of 90% of exterior walls using either insulated concrete forms (ICF) or precast autoclaved aerated concrete (AAC). Install ICF walls according to manufacturer’s specification, to a minimum of R-17 insulation, and meet state termite protection guidelines for ground contact insulation. Install AAC walls according to manufacturer’s specifications and meet the prescriptive requirements for mass walls as applicable in the 2009 IECC.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at pre-drywall inspection.

Energy Efficient Systems (ES)

INN ES 1.0 On-site fuel cell or cogeneration system

Criteria

Install on-site fuel cell or cogeneration system to provide energy (in the form of heat and/or electricity) to home.

**Confirmation**

- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

INN ES 1.1 Solar, micro-hydro or wind electric system

Criteria

Design and install a renewable energy system to power home (solar, micro-hydro or wind electric) that is capable of producing a minimum of 0.5 kW of power.

Clarifications

The company performing the installation must work with a licensed electrician.
**INN ES 1.2 Solar-Ready Home**

**Criteria**
Design and construct home with the intent of being retro-fitted with solar hot water and/or solar power. There must be space on lot for a solar power array that can produce at minimum 20% of homes electrical load. The space must allow the array to remain unshaded year round, be oriented to within 15 degrees of true south, and be angled horizontally within 15 degrees of latitude.

- Install and label conduits from the mechanical room and water heater to the attic.
- Install extra plumbing valves and fittings on the water heater and an electrical outlet at the planned solar tank location.
- Construction plans must designate future component (solar power and solar hot water) locations.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and visually confirm compliance at final inspection.

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**Water Efficiency (WE)**

**INN WE 1.0 Hot water demand ≤0.13 gal of water between loop and fixture and ≤0.2 gal of water in loop between water heater and furthest fixture**

**Criteria**
- Install a demand controlled hot water priming loop such that the volume from the loop to the hot water outlets is 0.13 gallons or less.
- Zone the hot water distribution system so that volume in one or more demand controlled priming loops is kept to less than 2 gallons from the water heater to the furthest fixture on the loop.
- Install buttons or motion sensors, either wired or wireless, in each hot water location to activate pump(s).
- Meet the installation procedures in ES 5.4 for pipe insulation.

**Clarifications**
- For pipe lengths to volume conversion, see Maximum Length of Pipe or Tube table under WE 1.9.

**Confirmation**
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria will visually confirm compliance at pre-drywall and final inspections.
The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the pre-drywall inspection. The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at pre-drywall inspection and test compliance at final inspection.

**INN WE 1.1 Kitchen and utility sink (if installed) have simple shut-off (hip bar/foot pedal, etc.)**

**Criteria**
Kitchen and utility sink (if installed) have simple shut-off (hip bar/foot pedal, etc.) to enable occupant to easily shut off and turn on water without resetting temperature during washing.

**Confirmation**
The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**INN WE 1.2 Composting toilet**

**Criteria**
Install one or more composting toilets. Any installed composting toilets must be capable of composting the waste and toilet paper quickly and without odor. The finished compost must be safe and easy to handle and evaporate any liquid.

**Clarifications**
Any composting toilet installed must comply with all applicable safety standards in place by the local and federal government.

**Confirmation**
The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**INN WE 1.3 Greywater system for toilet flushing**

**Criteria**
Install greywater system designed to capture, at a minimum, the greywater from the master shower and be reused for flushing the master toilet.

**Clarifications**
Any installed greywater system must comply with any and all applicable state and local laws.

**Confirmation**
The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

**INN WE 1.4 Rainwater harvest system for indoor water use**

**Criteria**
Install rainwater harvest system with minimum capacity, to flush at least one primary toilet in home or wash clothes.
Clarifications
Any installed rainwater system must comply with any and all applicable state and local laws.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

Education and Operations (EO)

INN EO 1.0 Install backyard composting bin

Criteria

A. With instructions for use
As part of the landscape plan, install a composting bin and provide user instructions to the homeowner.

B. With instructions for use and no garbage disposal
Instead of installing a garbage disposal, install a composting bin and provide user instructions to the home-buyer.

Confirmation
- The builder must present documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance of criteria and will visually confirm compliance of criteria at final inspection.

INN TBD Project specific innovation points: builder submits specifications for innovative products or design features to EarthCraft prior to construction completion

Criteria
Prior to certification, submit specifications for innovative products or design features to EarthCraft for approval to qualify for additional points.

Confirmation
- The EarthCraft Technical Advisor will submit to EarthCraft for approval and point award.