EarthCraft Multifamily
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 Multifamily V5 Technical Guidelines

The EarthCraft Multifamily V5 Technical Guidelines apply to all new construction and gut rehab projects in the EarthCraft Multifamily program permitted on or after January 1, 2016. The Technical Guidelines must be used in conjunction with the EarthCraft Multifamily Version 5 Workbook 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 should consult the Viridiant staff and/or 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 project 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 the EarthCraft website at 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 V5 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 V5 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 Multifamily V5 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 Multifamily V5 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. Under 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 should 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 Multifamily V5 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 should 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 should 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 burry-pit on site, the project 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 should 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 should not require the EarthCraft Technical Advisor to conduct further research or calculations.
  - 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.

  - 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.
  - 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
  - Indicates confirmation of criteria via photo documentation provided by the builder and reviewed by the EarthCraft Technical Advisor.
  - 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.
  - Photos must clearly illustrate criteria being confirmed as well as location in the project. At a minimum, photo documentation must:
    - Provide evidence of each measure outlined in the criteria.
    - Show both the general location and the specific strategy.
    - Be date stamped.
- Testing
  - 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.
  - 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 Multifamily 2014 Worksheet and Manual

Objective

The EarthCraft Multifamily Worksheet and the EarthCraft Manual provide project teams with detailed information and guidance on program implementation. The worksheet is the primary tool used to show compliance for an EarthCraft Multifamily project. The most recent worksheet should be downloaded from the EarthCraft website before each design review or new project seeks program compliance. This excel workbook includes a cover sheet indicating the projects score, an instructions tab for how to properly fill out and track the worksheet, the worksheet which illustrates which strategies the project has incorporated, a test sheet that provides blower door and duct leakage diagnostic testing results as well as an inspection notes tab. The EarthCraft Manual outlines roles and responsibilities for all project participants as well as a detailed process for certifying a project.

Instructions

The EarthCraft Builder or project team representative must complete an EarthCraft worksheet to show that the project will qualify for certification. The EarthCraft Multifamily Worksheet is an Excel spreadsheet that can be downloaded from www.viridiant.org. Each project seeking certification must complete a worksheet unique to the project. The EarthCraft project team analyzes the project prior to construction and selects the credits that they plan to achieve by placing the appropriate score next to each point value. EarthCraft Virginia reviews the worksheet at the Design Review, Pre-Drywall Inspection, and Final Inspection to clarify any questions that may arise during implementation, collects the required documentation (varies per line item), and verifies specific measures (varies per line item).

Disclaimer and Notices

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Also, please note that none of the parties involved in the funding or creation of the Technical Guidelines, including Southface, Viridiant, 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.

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Please note that the builder, architect, or primary project manager is solely responsible for choosing the EarthCraft Multifamily criteria that are appropriate for the project and for their proper installation. EarthCraft and its representatives are responsible only for verifying the completion of EarthCraft requirements as set forth in the Technical 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 Committee Members
- 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.viridiant.org.

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

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Site Planning

The location of a project and the plan for the area around that project can have a significant impact on both the resident's quality of life and on the environment. Selecting an appropriate site for a project 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 project team 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. ***Brownfield site***

Build project 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.

2. ***Previously developed site***

Build project on lot that has preexisting paving or construction on ≥75% of site.

3. ***Infill development site***

Build project on lot that is served by existing public sewer infrastructure and ensure that 50% or 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 should 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 Average density – dwelling units per acre

Criteria

Achieve dwelling unit per acre calculation of ≥15 dwelling units/acre, ≥20 dwelling units/acre, or ≥25 dwelling units/acre. This calculation will include all buildable land area within the project boundary, but may exclude permanently protected greenspace, floodplains, or tree-save areas. The acreage will be gross density of site including all parking lots, sidewalks, and other hardscape areas.

Example

One hundred dwelling units on a 5-acre lot with 1-acre preserved as a permanently protected tree save area. 100 units/(5 acres – 1 acre tree save) = 25 dwelling units per acre.

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.

Site Design

SP 2.0 Connectivity

Criteria

1. ***Walking distance to bus line (≤1/4 mile)***

Locate the primary entrance of the project 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 project 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 project 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 project within 1/4 mile of a park that is available for occupant use and greater than 3/4 acre in size. Measure distance by following a walk able 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 project 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).

A. Business district must have at least 6 or more distinct community resources. (e.g., one library, one school, one grocery store and one restaurant).

B. 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 Shade ≥50% of hardscapes within 30' of building

Criteria

To reduce local heat island effects, shade at least 50% of hardscapes (paved area including walkways, driveways, patios and tennis courts) within 30’ of the building. Shaded area should be calculated based on tree canopy coverage when the sun is directly overhead based on 5 years growth. Public walkways and roads should not be included in the hardscape calculation.

Clarifications

It is advantageous for durability to install plants that maintain ≥2’ clearance from buildings at maturity.

Sites that provide 40% shade of hardscapes at completion also qualify.

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

SP 2.2 Reduce light pollution – all exterior lights full cutoff

Criteria

Reduce light pollution by minimizing light trespass on site for the purpose of reducing sky-glow, increasing nighttime visibility and minimizing negative effects on nocturnal environments and human health and functioning.

Clarifications

All exterior lighting will have full cutoff ability to reduce outdoor light pollution.

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

SP 2.3 Permanent stormwater control

Criteria

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

1. Direct impervious surface runoff to appropriately sized rain gardens, swales, drywells or bioretention areas. Receiving area soils should 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.

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. ≥50% of onsite impervious surface areas

Projects must disconnect at least 50% of onsite impervious surface areas from storm drains by implementing some or all of the LID BMPs from the list above.

C. ≥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
- http://www.nrdc.org/water/pollution/storm/chap12.asp

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.

SP 2.4 Pervious paving for hardscapes and surface parking area with appropriate sub layers

Criteria

Pervious paving installed for at least 75% of hardscapes and parking area with appropriate sub layers.

Clarifications

To reduce storm water runoff, install pervious pavers for 75% of all hardscape areas on site and parking area. Appropriate sub layers used to allow proper drainage and function.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance with criteria at install

SP 2.5 Protect and restore riparian, wetland, and shoreline buffers

Criteria

Preserve, restore and enhance riparian, wetland, and shoreline buffers to improve flood control and water quality, stabilize soils, control erosion, and provide wildlife corridors and habitat.

Confirmation

- The EarthCraft Technical Advisor will visually confirm on site.

SP 2.6 Street trees are ≤40’ on center at minimum

Criteria

Plant or preserve shade trees at an average interval of ≤40 feet along 75% of new or existing streets internal to and immediately adjacent to the project boundary. Trees should be planted on both sides of internal streets and on the project side of adjacent streets.

Confirmation

- The project team must present documentation demonstrating compliance with criteria above from the projects landscape designer clearly indicating tree wells or strip dimensions, tree specifications, and street lengths.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and visually confirm compliance with criteria at final inspections.

SP 2.7 Improved connectivity to adjacent sites

Criteria

Promote multiple road connections off-site to improve vehicular ingress and egress and improve pedestrian connections to adjacent sites.

No street or pedestrian networks can be gated.

1. Improved vehicular access (2+ connections)

The project must provide ≥2 connections to the off-site road network. The vehicular access points must include sidewalk accommodations.

2. Dedicated pedestrian and bike access

Provide a non-vehicular pathway along the edge of the project's boundary adjacent to developed parcels and undeveloped parcels. Pedestrian and bicycle access to future phases of the same development do not qualify. However, plans to provide access in future phases to adjacent parcels will qualify.

Connections are not required where existing buildings, bodies of water, critical slope areas or other natural areas designated for preservation prohibit through streets.

Confirmation

- The project team must present documentation showing the locations of connections in compliance with criteria.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and visually confirm compliance with criteria at final inspections.

SP 2.8 Community gardens

Criteria

Promote open space and the production of locally grown, community maintained vegetation through community gardening areas. Community gardens provide a catalyst for community development while offering multiple benefits to the environment.

1. A fenced community garden will provide a minimum planting area equal to the mean size of all residential units.
2. The gardens must be a permanent fixture with storage areas provided for garden tools and products.
3. Post signs dictating rules and safety guidelines at garden entrance.
4. Provide a water source nearby for watering the garden. The water source should take into consideration best practices for water conservation. Rain barrels may be used, but not as the primary source of water.
5. The soil must be properly prepared for planting.
6. Gardens shall be surrounded on all sides with a minimum 4' high fence of weatherproof construction to discourage small children and animals from entering the garden. If pressurized wood is used for fencing or raised-beds, ensure the manufacturer verifies that it is safe to grow edible plants in soil surrounded by their wood product.
7. The effects of any contaminants discovered in the Phase I Environmental Assessment must be considered before choosing to build the garden.

Clarification

If the development has 3 unit types (1 bed is 750 square feet, 2 bed is 900 square feet, and 3 bed is 1200 square feet), determine the mean of the floor plans to determine the required square footage of the garden plot.

$$\frac{750+900+1200}{3(\text{unique unit types})} = 950 \text{ square feet required}$$

Confirmation
- The project team must present documentation showing the location and size of the community garden in compliance with the criteria above. The garden must also incorporate all requirements listed above.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and visually confirm compliance with criteria at final inspections.

SP 2.9 Outdoor Community gathering space

Criteria

Provide outdoor gathering space large enough to accommodate at least 5 people, for the purpose of building community and improving social ties. Gathering space should have adequate seating, lighting, and shade provided by either nearby trees or structures such as a pavilion.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at install

SP 2.10 Install local endangered plant species on site to promote ecological productivity

Criteria

Install native endangered plant species on site to promote ecological productivity

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at install

SP 2.11 Install plant species that serve as pollinators on site for regional wildlife

Criteria

Install native plant species that serve as pollinators for regional animal and plant communities certified by a wildlife biologist, horticulturist and landscape architect.

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at install

SP 2.12 Parking reduced below local ordinance (1:1 ratio)

Criteria

Reduce the amount of parking below a 1:1 ratio and below local zoning ordinance requirements and/or provide no new parking on site.

Confirmation
- The project team present documentation showing the local parking ordinance and the number of parking spaces on site, clearly showing the criteria above is achieved.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and visually confirm compliance with criteria at final inspections

Site Preparation and Preservation Measures

SP 3.0 Workshop on erosion and sediment control

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 and tree-save potential

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

SP 3.2 Erosion and sedimentation control plan

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 should 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' should 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 should 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 plants on site

Criteria

The builder must not install invasive plants on site as defined by the local agricultural extension office and/or landscape architect.

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 3.4 Comply with all federal, state and local government erosion control and protection measures

Criteria

Project must meet all federal, state and local government erosion control and protection measures.

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

SP 3.5 Phase I environmental testing and remediation plan

Criteria

Comply with all federal guidelines regarding Phase I environmental site assessments. If the phase I shows the need for soil or building abatement the team must show compliance with clean-up requirements through the Phase II assessment (or greater).

Confirmation
- The project team will provide a copy of Phase I assessment results as requested by the EarthCraft Technical Advisor. If additional phase assessments are conducted these may also be requested.

SP 3.6 On-call personnel designated for erosion control during rain events

Criteria

The project team must designate on-call personnel for the purpose of maintenance/ repair of erosion control measures during rainfall events. The on-call personnel must possess an active Certified Land Disturber (RLD) certification from the appropriate state soil and water conservation regulatory body.

Confirmation
- The project team will identify the point person and provide a copy of the 1A certification as requested by the EarthCraft Technical Advisor.

SP 3.7 Downstream water quality testing (if applicable)

Criteria

The project must comply with stormwater discharge limitations required by the Federal Clean Water Act. If applicable, the general contractor will submit an updated Nephelometric Turbidity Units (NTU) report to the EarthCraft Technical Advisor before, during, and after construction is complete.

Clarifications

An EC Technical Advisor may request turbidity tests at any time. If test records indicate levels exceeding what is locally allowable, project personnel and contractor are responsible for adjusting best management practices to meet established performance targets.

If turbidity tests exceed allowable levels for two consecutive storm events, the project will be required to host a mandatory meeting between site contractor, turbidity testing agency and project manager to determine necessary changes for compliance. Documentation of the meeting must be submitted to ECMF.

If turbidity tests exceed allowable levels for a third consecutive storm event, the project will be unable to certify as an ECMF.

For allowable limits based on site acreage and stream types please review the NTU limits from your appropriate state authority.

For the Commonwealth of Virginia please visit the Department of Conservation and Recreation. http://www.dcr.virginia.gov/

Confirmation
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor during the inspection phase.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria.

SP 3.8 Label all storm drain or storm inlets to discourage dumping of pollutants

Criteria

Label each storm drain within the development to discourage tenants from dumping pollutants in storm drains.

Confirmation
- The EarthCraft Technical Advisor will visually verify for compliance during final inspections.

SP 3.9 Road/vehicle cleaning protocols posted and enforced

Criteria

Designate a tire and vehicle washing area during the construction phase of the project. Create protocols to enforce both vehicle and road cleaning processes.

Clarifications

The vehicle cleaning area will have a clean path to, and will be located within 100 feet of the construction entrance. The area should consist of a 32 ft. x 12 ft. gravel bed atop permeable ground, and should have adequate water access for washing purposes.

This area should be properly documented in the Erosion and Sedimentation plan, Site plan, and marked on site. Washing must be enforced.

The project team should create protocols for off-site road cleaning to remove sediment and debris carried from the construction site.

Confirmation
- The projects civil engineer or other professional will identify the location and requirements for the above criteria within the projects site plans.
- The EarthCraft Technical Advisor will visually confirm location of the wash out station during the EarthCraft Kick-Off meeting.

SP 3.10 Tree preservation and protection measures employed on site

Criteria

Use mature vegetation to create a sense of place, aid in mitigation of heat island effect and preserve natural landscape.

Preserve at least 25% of existing trees that have a chest-height (4 feet above the ground) diameter of 8 inches or more. The tree root zones of the selected trees must be protected with a physical barrier during all site clearing, grading and construction activities.

Create a Tree Preservation Plan that includes the following:

Tree Survey

- Consult with a certified arborist to assess the existing tree stock prior to establishing the building footprint.
- Determine which trees are in good health and have cultural, native, aesthetic and/or monetary significance.

Tree Protection

- Clearly indicate tree-save areas and protection measures in construction documents.
- Tree(s) must be fenced around the drip line throughout the construction process with tall, bright, protective fencing.
- Avoid soil being placed on top of any root zone for trees that are designated for preservation. Ensure the protected tree species' needs for growth, sunlight and water integrate well with the new building design.

Resources

North Carolina State University, Construction and Tree Protection www.ces.ncsu.edu

Confirmation

- The project team will identify tree preservation potential and identify the trees to be saved within the projects site plans.
- The EarthCraft Technical Advisor will visually verify the tree protection measures are appropriately employed and provided for the identified trees. Confirmation will begin at the EarthCraft Kick-Off meeting and continue until project completion.

SP 3.11 Leave site undisturbed and protect greenspace (min 25%) from future development

Criteria

The site will permanently protect a minimum of 25% of buildable land area as permanent greenspace.

Clarifications

Buildable land area will exclude any areas that are protected through federal, local, or state requirements. Areas already required to be protected such as floodplains or specific project boundaries can only count towards the tree save percentage if the project team can develop permeable pathways to utilize the area as a community amenity.

Confirmation

- The project team must present documentation clearly identifying the percentage of greenspace protection complying with the criteria above.
- The EarthCraft Technical Advisor will visually verify the greenspace protection measures. Confirmation will begin at the EarthCraft Kick-Off meeting and continue until project completion.

SP 3.12 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 project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria.

SP 3.13 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.

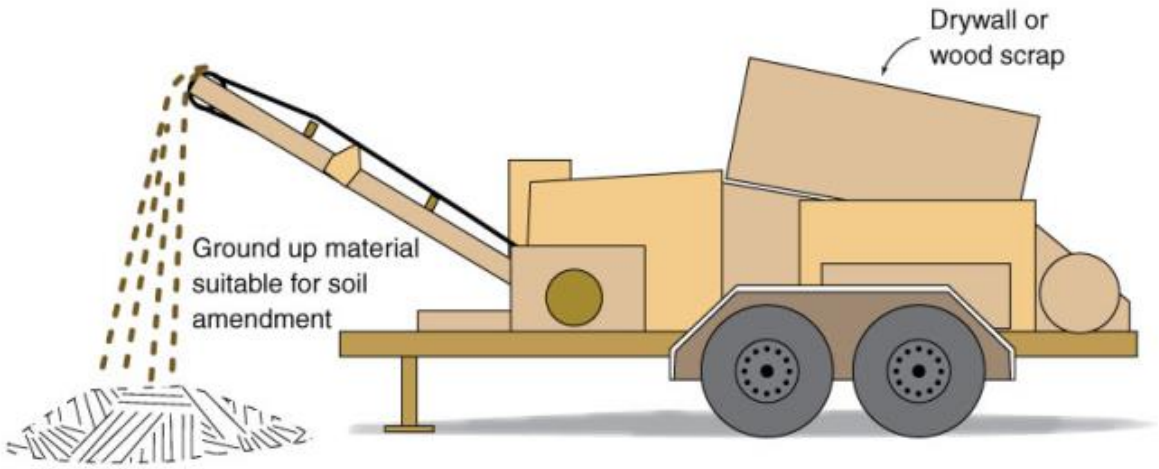


Figure 1: Waste grinder

Confirmation
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at the EarthCraft Kick-Off Meeting.

SP 3.14 Tree planting (12 trees per acre; trees ≥2" diameter)

Criteria

Plant a minimum of 12 trees per acre. All trees must be ≥2" in diameter at breast height (DBH).

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

Alternative Transportation Accommodations

SP 4.0 Bike Racks

Criteria
Provide bike racks for ≥10% of dwelling units.

Confirmation
- The project team will identify bike rack location and capacity on site plan.
- The EarthCraft Technical Advisor will confirm at final inspection.

SP 4.1 Covered bike storage facility

Criteria
Provide Bike racks for ≥10% of dwelling units in a covered and secure location.

Confirmation
- The project team will identify bike rack location and capacity on site plan.
- The EarthCraft Technical Advisor will confirm at final inspection.

SP 4.2 Tenant access to business center

Criteria
Provide community accessible meeting spaces for tenant use. Areas will have internet and phone capacity. Tenants will be allowed to sign up and use the meeting space in common areas for private business needs.

Confirmation
- The project team will include program in management guidelines and educate tenants upon move-in.
- The EarthCraft Technical Advisor will confirm at final inspection.

SP 4.3 Covered bus stop

Criteria
This development will provide a covered bus stop that meets the intent of the regularly scheduled bus service.

Confirmation
- The project team will identify bus stop on site plan.
- The EarthCraft Technical Advisor will confirm at 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.

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 Only state-approved landfills may be utilized

Criteria

Only state-approved landfills may be utilized for waste disposal.

Confirmation

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

CW 1.2 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 75% or greater (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 (including beverage containers)

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 (including beverage containers)

Avoid disposal of a minimum of 75% (by weight or volume) of plastic generated from construction, including contractor beverage containers.

6. Shingles

Avoid disposal of a minimum of 75% (by weight or volume) of shingles generated from construction. Recycled shingle scraps offer a variety of uses including gravel substitutes for the wearing surface for rural roads, asphalt cement modifier and aggregate substitute and mineral filler for asphalt paving mixes.

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 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.

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 project to use less wood and by practicing simple measures to ensure that wood on site is used properly, a new construction project can reduce its impact to 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 buildings 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 project'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 buildings have on the environment, including the impacts that result from the extraction and manufacture of materials used in construction. By choosing certain building materials, an EarthCraft project can conserve natural resources, prevent unnecessary waste and reduce pollution associated with manufacturing and transporting of materials.

Resource Efficient Design

RE 1.0 Limit framing at all windows and doors

Criteria

Limit framing at windows to a maximum of one pair of king studs and one pair of jack studs per window opening to support the header and window sill. Additional jack studs shall be used only as needed for structural support and cripple studs only as needed to maintain on-center spacing of studs.

Clarifications

The builder must present construction documents demonstrating structural requirements for excess framing, such as additional jack studs or excess cripple studs.

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

RE 1.1 Engineered roof framing (≥90%)

Criteria

Construct 90% of roof framing using non-dimensional (engineered) structural wood, such as engineered trusses, pre-fabricated I-beams or non-wood material, such as steel. All engineered wood products must have no added urea-formaldehyde. If constructing a steel truss ceiling or steel joist ceiling, the entire exterior surface of the studs must be covered with a minimum of R-7.5 insulated sheathing.

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

RE 1.2 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).

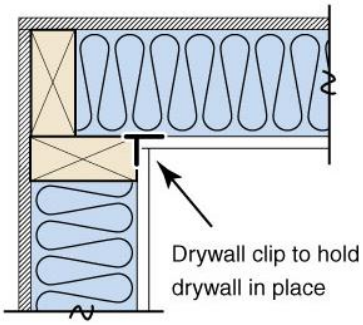


Figure 2: 2-stud corner

2. Ladder T-walls at all locations

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

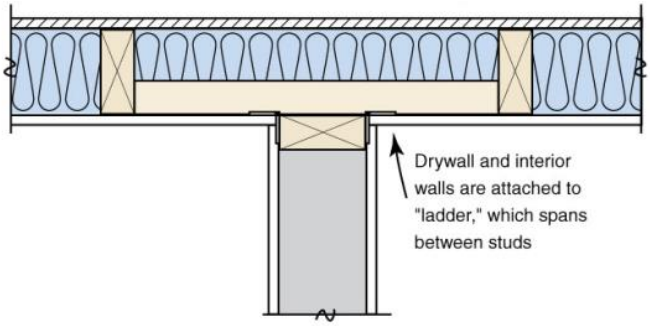


Figure 3: Ladder T-wall

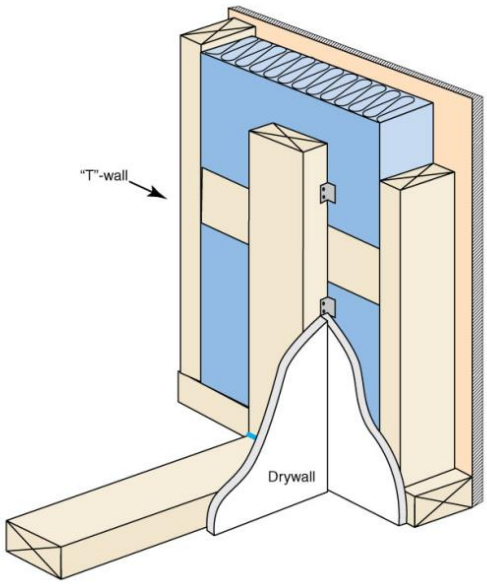


Figure 4: Ladder T-wall

3. Size headers for loads (non-structural headers in non-load bearing walls)

Design and install appropriately sized headers in all walls where structurally feasible. 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.

If installing a ladder T-wall, begin first ladder 2' above the subfloor to aid in the installation of drywall.

Confirmation

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

RE 1.3 Average floor area of unit

Criteria

A. < 800 sq ft

The average conditioned floor area of all units is less than 800 sq ft.

B. 800-1,100 sq ft

The average conditioned floor area of all units is between 800 and 1,100 sq ft.

Clarifications

The average floor area must be derived from the areas specified by the conditioned floor areas in the unit schedule.

Confirmation

- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor.

- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with criteria at pre-drywall and final inspections.

RE 1.4 Floor joists are 24" on center (≥80%)

Criteria

Space at least 80% of all floor joists at 24" on center to minimize material waste.

Confirmation

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

RE 1.5 Non-load bearing wall studs are 24" on center

Criteria

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

Clarifications

The project team 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 with criteria at pre-drywall inspection.

Advanced Framing Products

RE 2.0 Precast insulated foundation walls (≥90%)

Criteria

Construct a minimum of 90% of foundation walls using insulated precast concrete foundation walls. Foundation wall insulation must meet the prescriptive requirements for basement or mass walls as applicable in the 2009 IECC. Install walls according to manufacturer specifications.

Confirmation

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

RE 2.1 Insulated concrete forms or precast autoclaved aerated concrete (≥90%)

Criteria

1. ***Foundation walls***

Construct a minimum of 90% of foundation 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 basement or mass walls as applicable in the 2009 IECC.

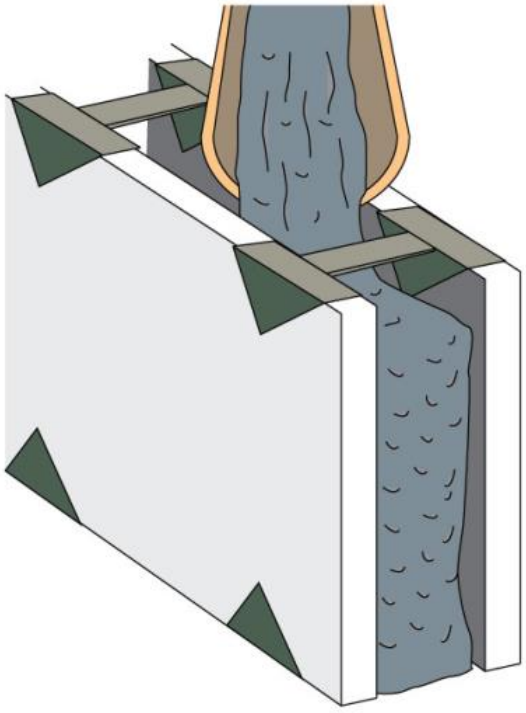


Figure 5: Insulated concrete form (ICF)

2. Exterior Walls

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.

RE 2.2 Engineered wall framing (≥90%)

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 criterion. 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 2.3 Deliver panelized construction or SIPs to the site pre-framed (≥90%)

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 Zone 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 Zone 4, demonstrating code compliance for trade-offs where appropriate. In all cases, install panelized roof according to manufacturer specifications.

4. *Modular construction*

Construct above grade sections off site and deliver in modules to the site.

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.

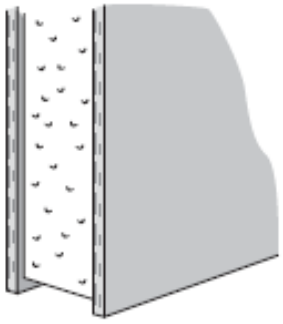


Figure 6: Structural insulated panel (SIP)

Confirmation

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

RE 2.4 Structural headers are steel or engineered wood (≥90%)

Criteria

A minimum of 90% of the total headers must be manufactured from non-solid sawn wood, such as laminated wood (e.g., laminated veneer lumber (LVL), laminated strand lumber (LSL)), prefabricated insulated I-joist or steel beams. 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.

Local, Recycled and/or Natural Content Materials

RE 3.0 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).

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

Criteria

1. ***Slab and/or foundation walls***

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

2. ***Exterior cladding and trim***

Replace ≥25% of the cement with fly ash or slag in all concrete used for ≥75% exterior cladding and trim.

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 3.2 Sustainably harvested, FSC certified

Criteria

1. ***Lumber (≥50%)***

50% or greater of lumber used in project must be Forestry Stewardship Council (FSC) certified. FSC certified wood comes from forests that are managed to maintain ecological health and biodiversity.

2. Lumber/millwork: FSC tropical wood (100%) or use no tropical wood

All tropical wood, including lumber and millwork, in project must be Forestry Stewardship Council (FSC) certified. FSC certified wood comes from forests that are managed to maintain ecological health and biodiversity.

OR

Use no tropical wood in project, including all lumber and millwork.

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 Use building materials extracted, processed and manufactured ≤500 miles from site

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 1 point; no more than five products may receive credit for these points.

Confirmation
- The project team must submit documentation demonstrating compliance with the criteria above. This can come in the form of product literature or official correspondence with a representative of the material manufacturer.

RE 3.4 Reused, recycled, MDF with no added urea-formaldehyde, local species or FSC certified wood

Criteria

1. Cabinet faces

Install cabinet faces either made from reclaimed wood, Medium Density Fiberboard (MDF) with no added urea-formaldehyde, FSC certified wood or other durable natural material from a local source (≤500 miles from site) such as wood. Reused cabinet faces and cabinet faces made of ≥25% recycled content also qualify.

2. Countertops

Install countertops made from reclaimed wood, FSC certified wood or other durable natural material from a local source (≤500 miles from site) such as stone. Reused countertops and countertops made of ≥25% recycled content also qualify.

Clarifications

Install only structural plywood and OSB certified compliant with PS1 or PS2 and made with moisture-resistant adhesives as indicated by "Exposure 1" or "Exterior" on the American Plywood Association (APA) trademark.

Install only hardwood plywood certified compliant with the formaldehyde emissions requirements of ANSI/HPVA HP-1-2004 and U.S. HUD Title 24, Part 3280, or certified compliant with CA Title 17.

Install only particleboard and MDF certified compliant with the formaldehyde emissions requirements of ANSI A208.1 and A208.2, respectively, and U.S. HUD Title 24, Part 3280, or certified compliant with EPPS CPA 3-08 by the CPA Grademark certification program, or certified compliant with CA Title 17.

Install only cabinetry made with component materials certified with the above requirements or registered brands or produced in registered plants certified under KCMA's Environmental Stewardship Certification Program (ESP 01-06).

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.

RE 3.5 Exterior cladding and trim (≥25% recycled content material on ≥75% area)

Criteria
Install ≥75% of exterior cladding and trim with ≥25% recycled content material (pre or post-consumer, excluding fly ash) content by weight or volume. Recycled content must be certified by Scientific Certification Systems (SCS).

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 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 3.6 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 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 3.7 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. Recycled content must be Scientific Certification Systems (SCS) certified.

3. ***Carpet (≥50% recycled content material on ≥50% of all carpeted floor area)***

Install carpet with ≥50% recycled content (pre or post-consumer) on 100% of carpet floor area. Recycled content must be Scientific Certification Systems (SCS) certified.

4. ***Biodegradable carpet and backing (≥50% of all carpeted floor area)***

Install carpet and backing that is constructed of organic materials (e.g., wool, hemp, etc.) that is readily biodegrade when exposed to moisture and sunlight on 50% of all carpeted 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 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.

RE 3.8 Engineered trim

Criteria

1. ***Interior (≥80%)***

Construct 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%)***

Construct 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 3.9 Roofing material (≥50% recycled content material on ≥90% area)

Criteria

Install roofing shingles, tile or other equivalent ≥50% recycled content materials on ≥90% of entire roof area.

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.

Building Reuse

RE 4.0 Gut Rehab or Adaptive Reuse

Criteria

The project will qualify as gut rehabilitation if a substantial renovation occurs and includes exposure of the wall cavities (through removing interior walls or exterior cladding) to allow for confirmation of air sealing and insulation requirements.

The project will qualify as an adaptive reuse project if the building shell is repurposed from a non-residential use to a residential dwelling structure.

For any adaptive reuse project, the project design must follow the adaptive reuse priority list found in the EarthCraft Multifamily worksheet.

Confirmation
- The EarthCraft Technical Advisor and EarthCraft Project Manager can help clarify whether a building will qualify as Gut Rehab or Adaptive Reuse.

Durability and Moisture Management

An important aspect of building sustainably is ensuring durability throughout a project's life cycle. The EarthCraft Multifamily program recognizes that proper design and installation are integral to building a durable building with minimal moisture management issues. Reducing the life cycle costs due to maintenance, repair and replacement decreases the impact that 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 or 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.

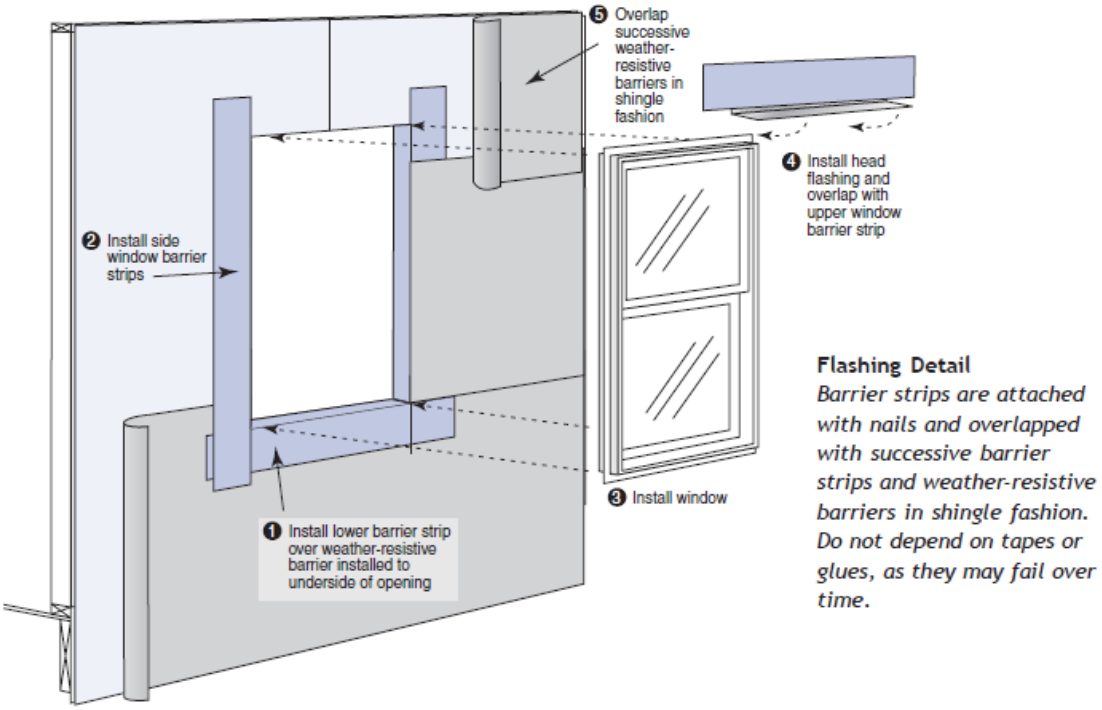


Figure 7: Example of manufacturer's specifications for drainage plane installation

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.

DU 1.2 Integrate drainage plane

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.

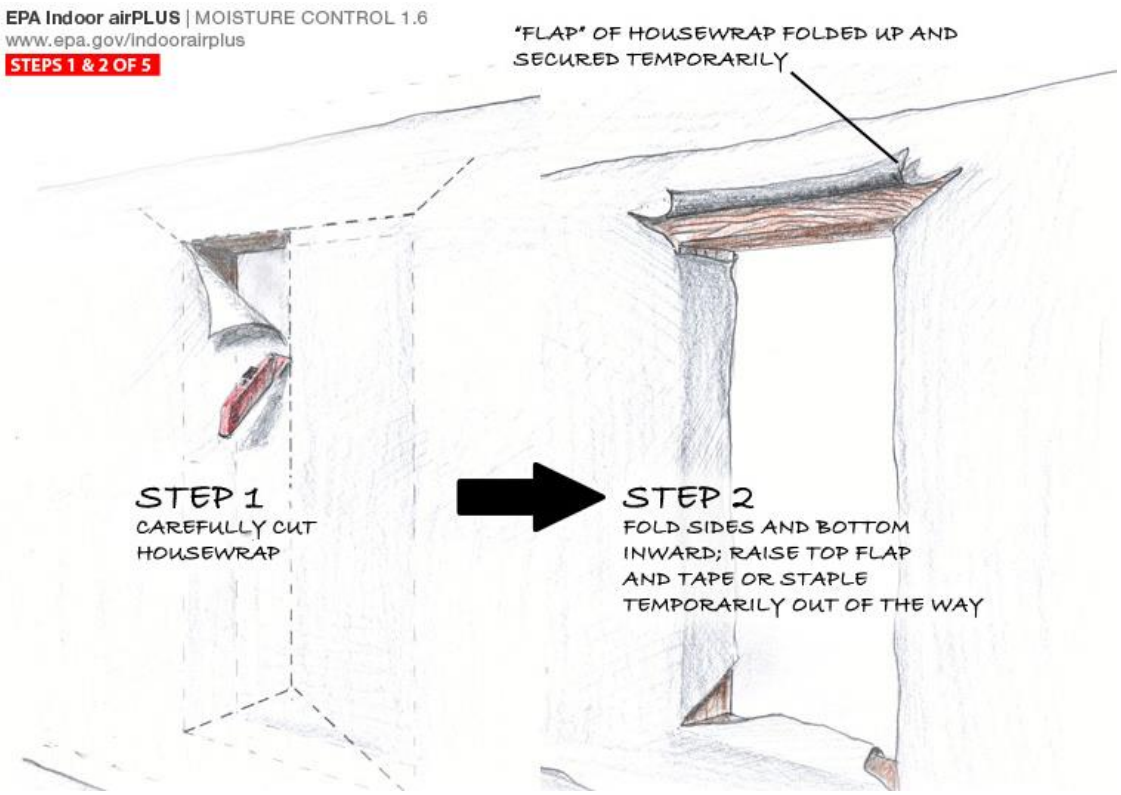


Figure 8: Steps 1&2: Preparing house wrap or builder paper (Graphic courtesy of US EPA Indoor airPLUS)

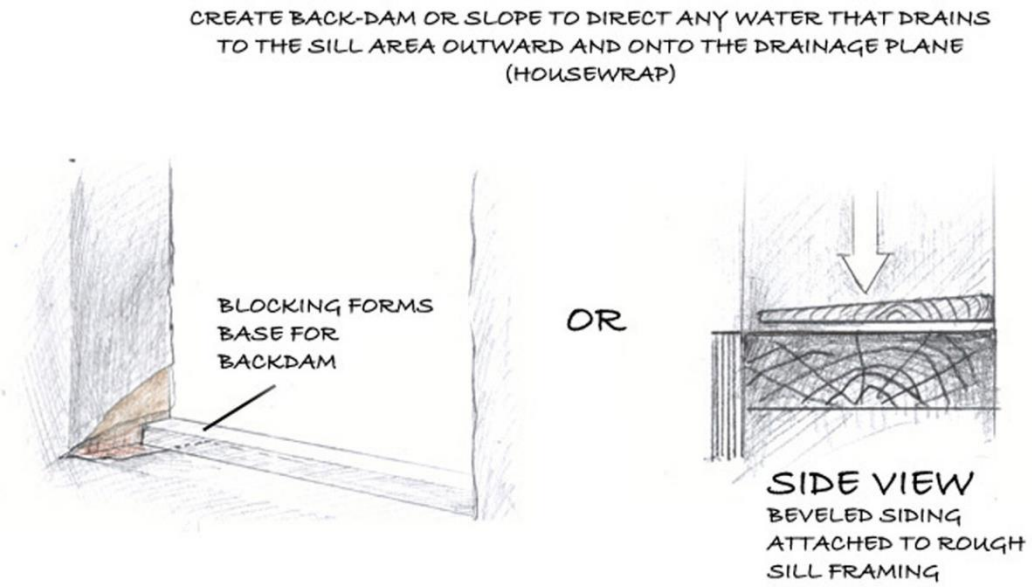


Figure 9: Step 3: Create back dam or slope away from interior (Graphic courtesy of US EPA Indoor airPLUS)

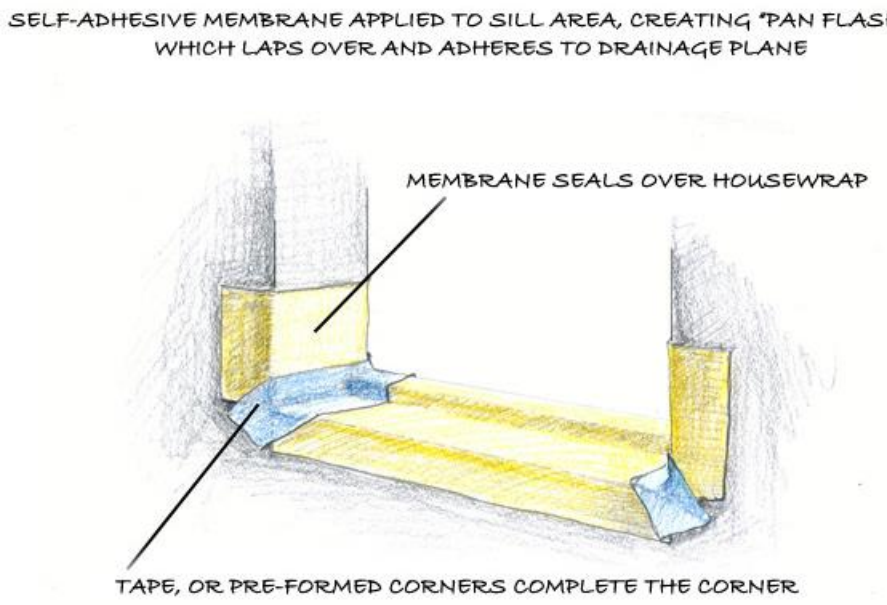


Figure 10: Step 4: Pan flashing - Option 1
(Graphic courtesy of US EPA Indoor airPLUS)

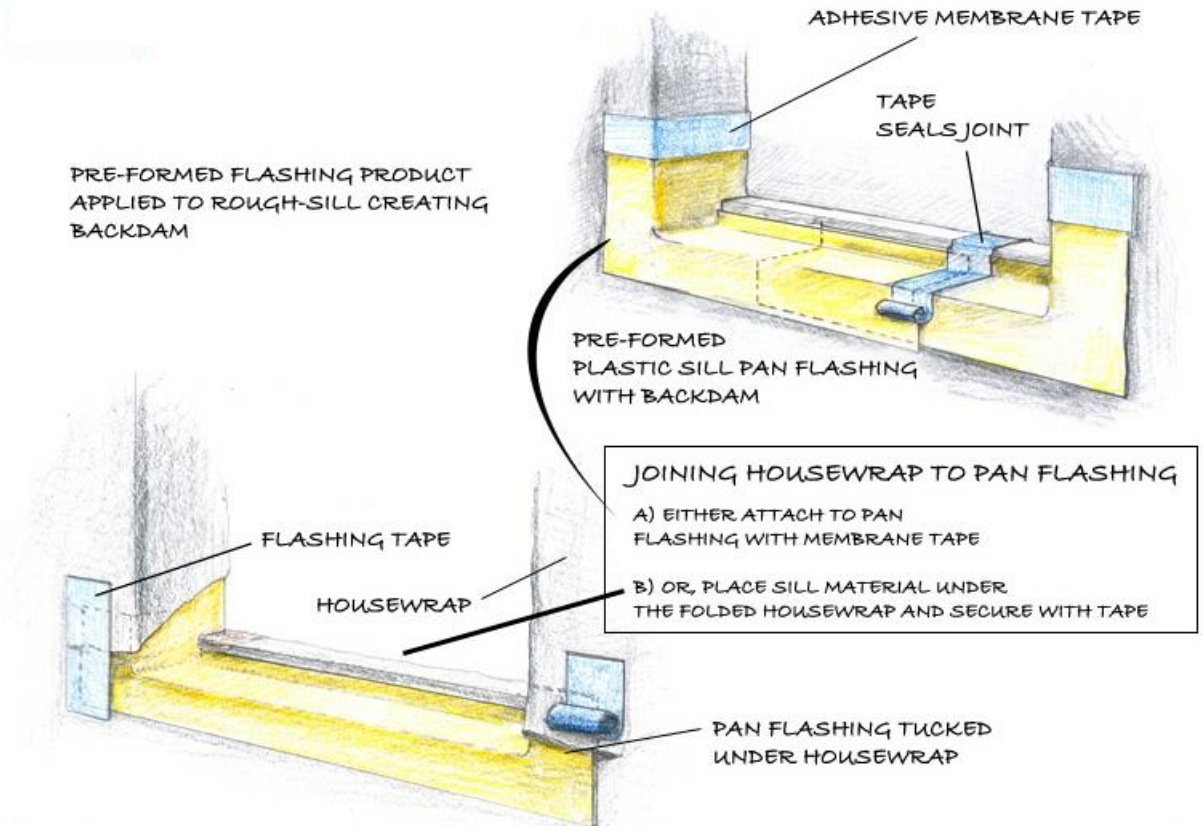


Figure 11: Step 4: Install plan flashing - Option 2
(Graphic courtesy of US EPA Indoor airPLUS)

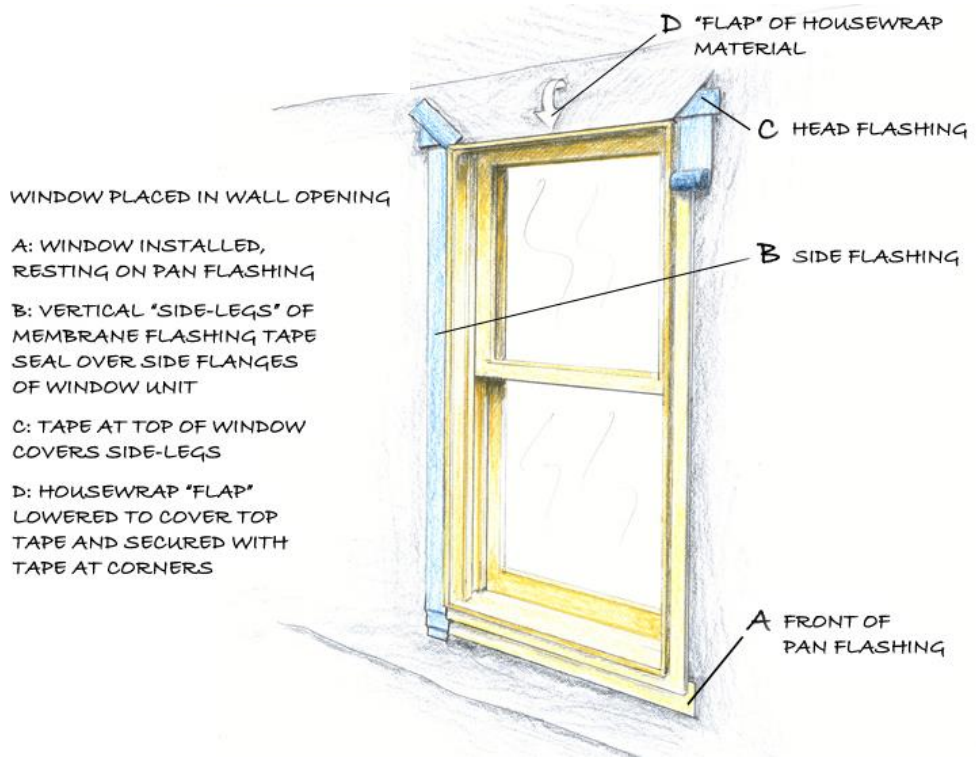


Figure 12: Step 5: Finishing window installation (Graphic courtesy of US EPA Indoor airPLUS)

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 ≥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 ≥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.

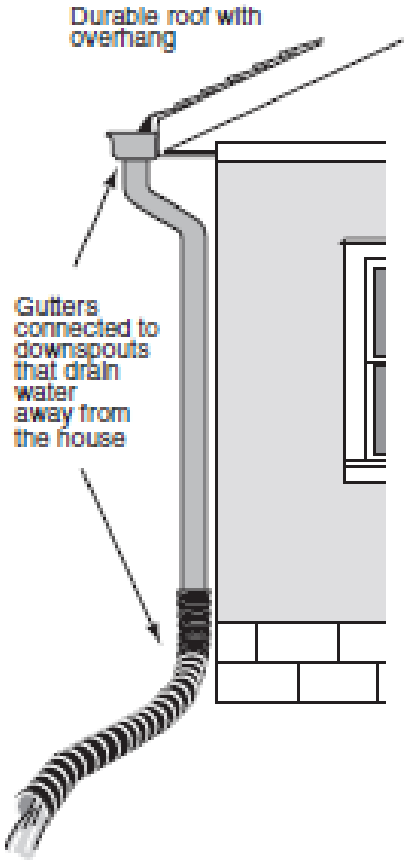


Figure 13: Roof gutters connected to downspout for proper drainage

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

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.

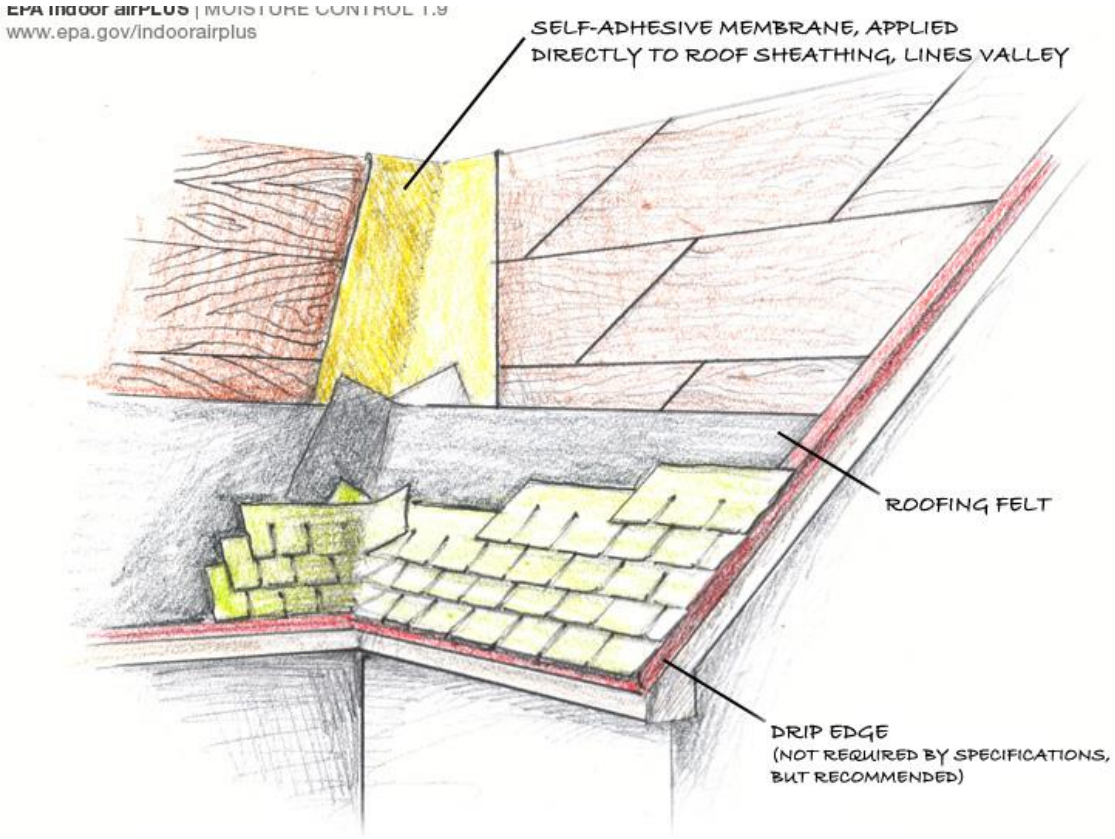


Figure 2: Membrane protection of roof valley
(Graphic courtesy of US EPA Indoor airPLUS)

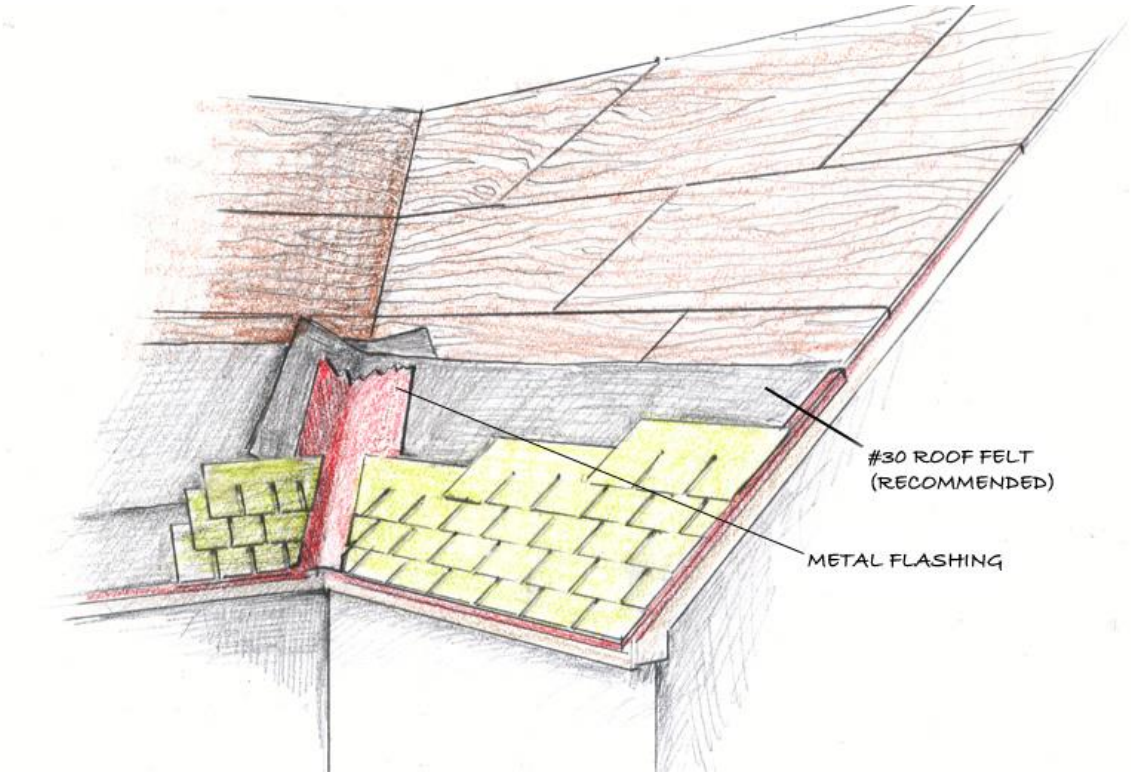


Figure 15: Metal coil stock flashing formed to valley
(Graphic courtesy of US EPA Indoor airPLUS)

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.

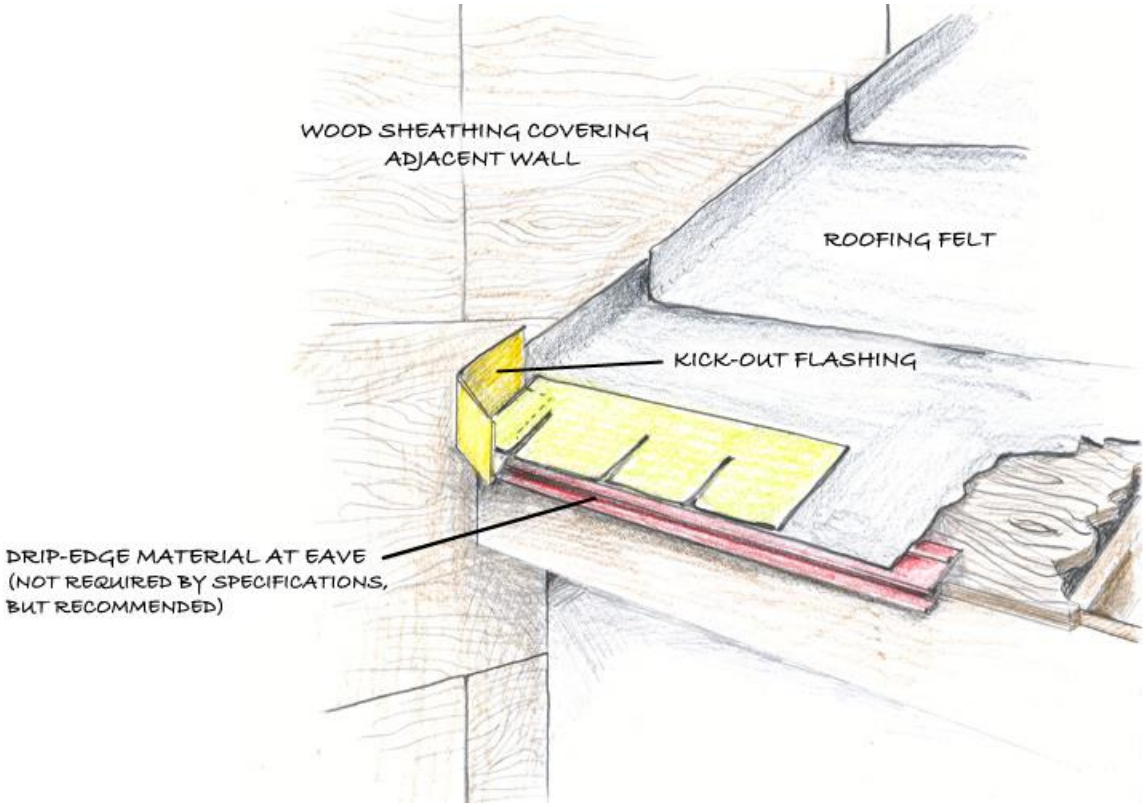


Figure 16: Step 1: Kick-out flashing beginning run of step flashing (Graphic courtesy of US EPA Indoor airPLUS)

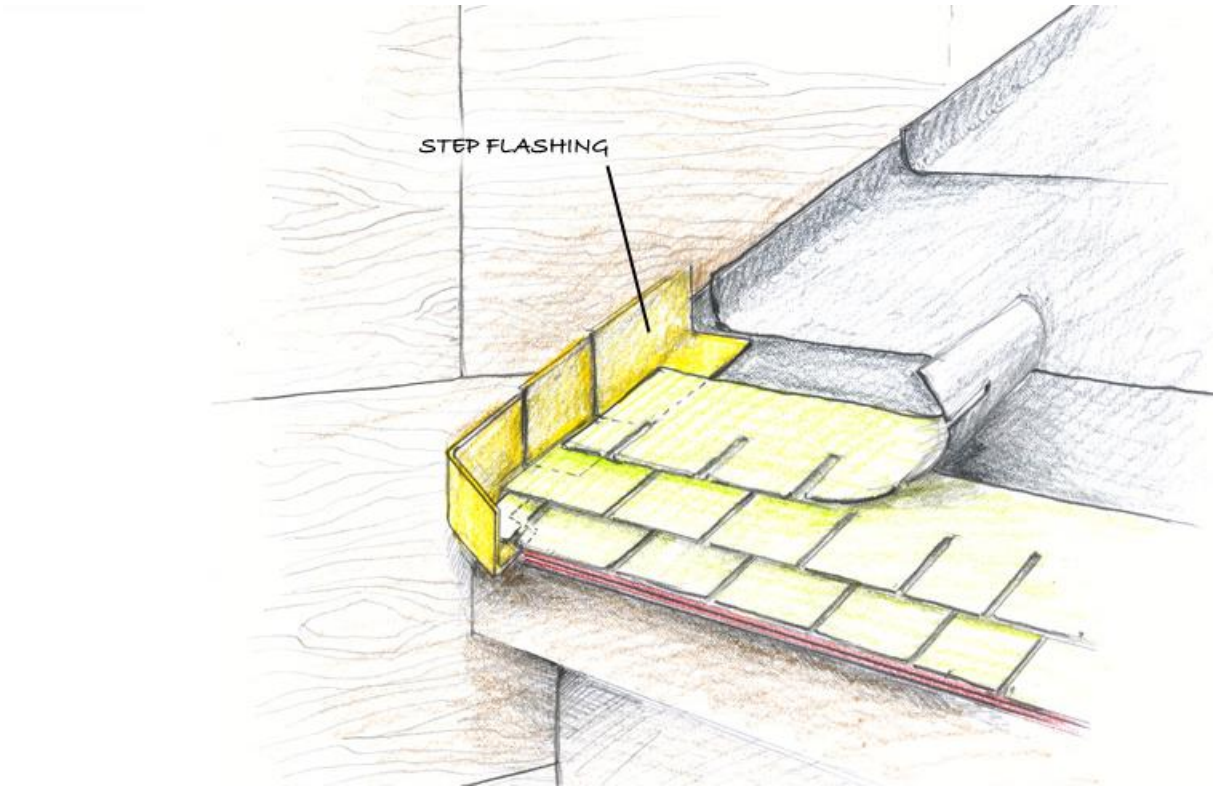


Figure 17: Step 2: Successive sections of step flashing integrated with courses of shingles (Graphic courtesy of US EPA Indoor airPLUS)

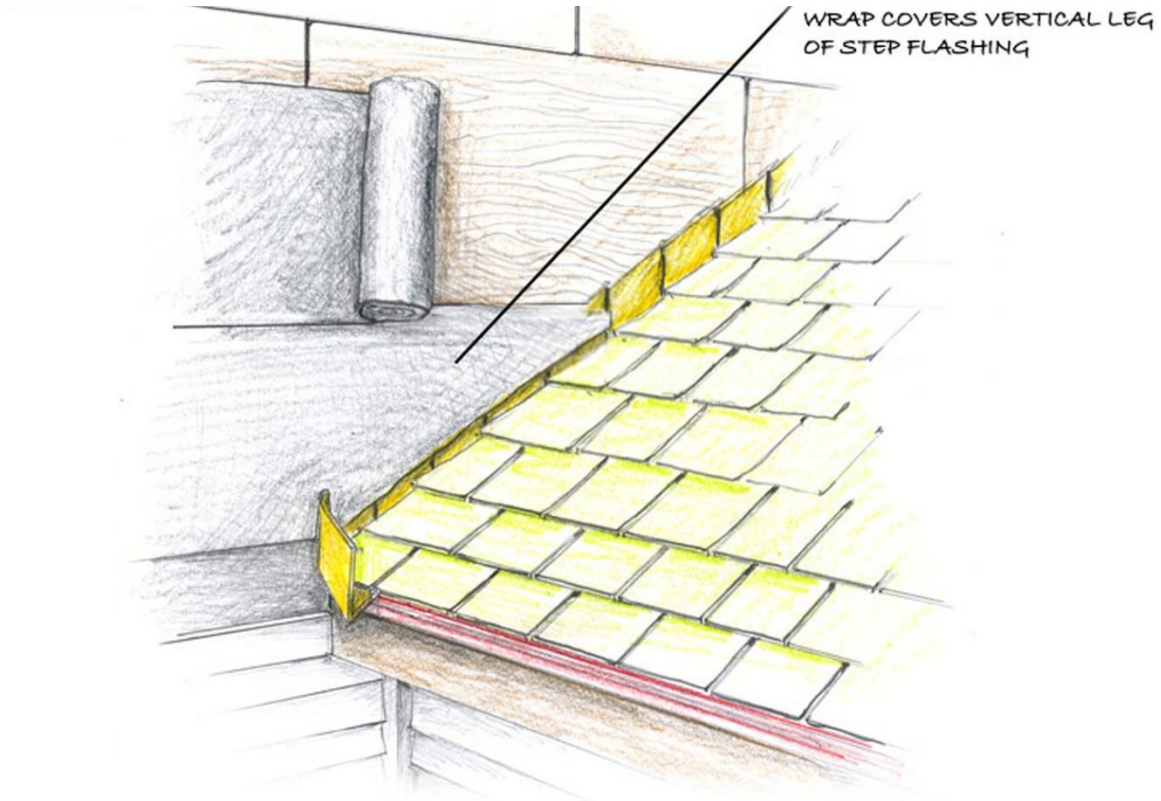


Figure 18: Step 3: Drainage plane material covers step flashing (Graphic courtesy of US EPA Indoor airPLUS)

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 Continuous foundation termite flashing (required if slab edge is insulated)

Criteria

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 project team will illustrate compliance through photo documentation submitted to the EarthCraft Technical Advisor at pre-drywall.
- Project team must provide section details prior to the construction

DU 1.7 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 1.8 Install air conditioner condensing unit pad

Criteria

Install condenser unit pad for all outdoor air-conditioner and heat pump condensing units.

Confirmation

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

DU 1.9 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 with criteria at pre-drywall inspection.

DU 1.10 Drain pan for water heaters and washing machines

Criteria

Install an appropriately sized drain pan underneath all hot water heaters and washing machines.

Confirmation

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

DU 1.11 If installed, crawlspace must be closed

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 2.1 100% coverage of ≥6 mil vapor barrier in crawlspace or beneath slab
- DU 2.6 Capillary break
- IAQ 1.1 Sealed-combustion furnace or isolate furnace from conditioned space
- IAQ 1.2 Sealed-combustion, power vent or electric water heater, or isolate water heater from conditioned space
- BE 1.5 Seal penetrations through
- BE 1.9 Install weather stripping at all exterior doors
- BE 3.16 Seal and insulate crawlspace walls

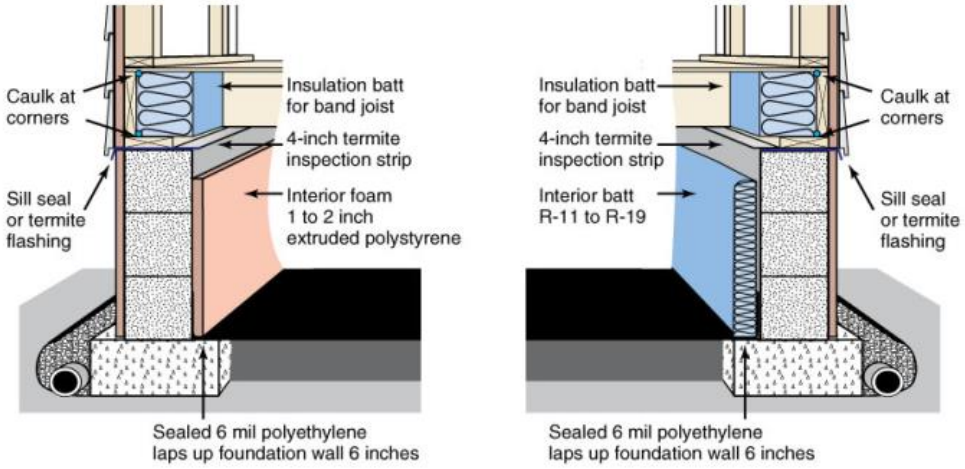


Figure 19: Enclosed crawlspace with insulation along walls

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 visually confirm compliance of criteria at pre-drywall and final inspections.

DU 1.12 Moisture-resistant wallboard in bathrooms

Criteria

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

Moisture-resistant gypsum board must be installed on exposed walls and ceilings above tubs and showers where the wall is not covered by tile or a panel assembly.

Moisture-resistant gypsum board must be installed on exposed walls behind bathroom sinks and kitchen sinks when the wall is not covered by tile or other water-resistant splash back assemblies.

Clarifications

Do not use paper-faced backer-board or gypsum-based backer-board (i.e., green board) behind the sink, tub, and shower assemblies.

Confirmation

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

DU 1.13 Alternative termite treatment with no soil pretreatment

Criteria

Install an alternative termite treatment system with no soil pretreatment.

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

Confirmation

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

DU 1.14 Non-toxic pest treatment

Criteria

1. ***All lumber in contact with foundation (≥36" 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. ***All lumber***

Pre-treat all lumber with a non-toxic pest treatment such as borate.

3. ***Mold inhibitor with warranty applied to lumber***

Apply a non-toxic mold inhibitor with warranty to all lumber.

Confirmation

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

DU 1.15 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.

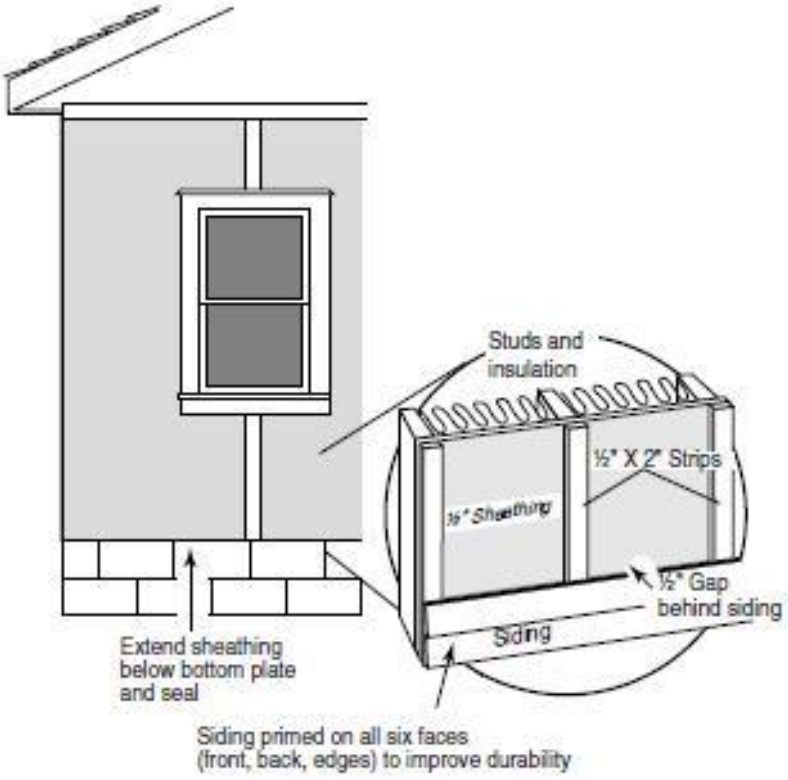


Figure 20: Site-built vented rain screen

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 1.16 Install termite mesh system

Criteria

Install a termite mesh system that conforms to ASTM A 478 and ASTM A 580/A 580M, Type A1AA marine grade 316 stainless steel mesh of 0.18 mm (0.007") diameter wire with mesh openings of 0.66 x 0.45 mm. (0.026" x 0.018"). Follow manufacturer's installation specifications for proper termite prevention.

Confirmation

- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm at pre-drywall inspection.

DU 1.17 Exterior cladding (≥75% facade) with 30-year warranty

Criteria

1. Exterior cladding (≥75% facade) with 30-year warranty

Install exterior wall cladding with a 30-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.

Confirmation
Exterior cladding with 30-year warranty
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm at pre-drywall inspection.

DU 1.18 Windows, doors and skylights with ≥25-year warranty

Criteria

All installed exterior windows, doors and skylight assemblies must have ≥25-year manufacturer's warranty.

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

DU 1.19 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 with criteria at pre-drywall inspection.

DU 1.20 All entrance doors have overhang ≥3' depth

Criteria

On all exterior doors, including building entrances and exits, install a covered entry way that extends 3' out from door.

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

DU 1.21 Roofing warranty

Criteria

A. 40-year warranty

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

B. 50-year warranty

Install shingles or other exterior roofing material that have ≥50 year manufacturer's warranty.

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

Moisture Management

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 building. Provide 100% coverage. Overlap all vapor barrier joints a minimum of 6".

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

DU 2.2 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 ≥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.

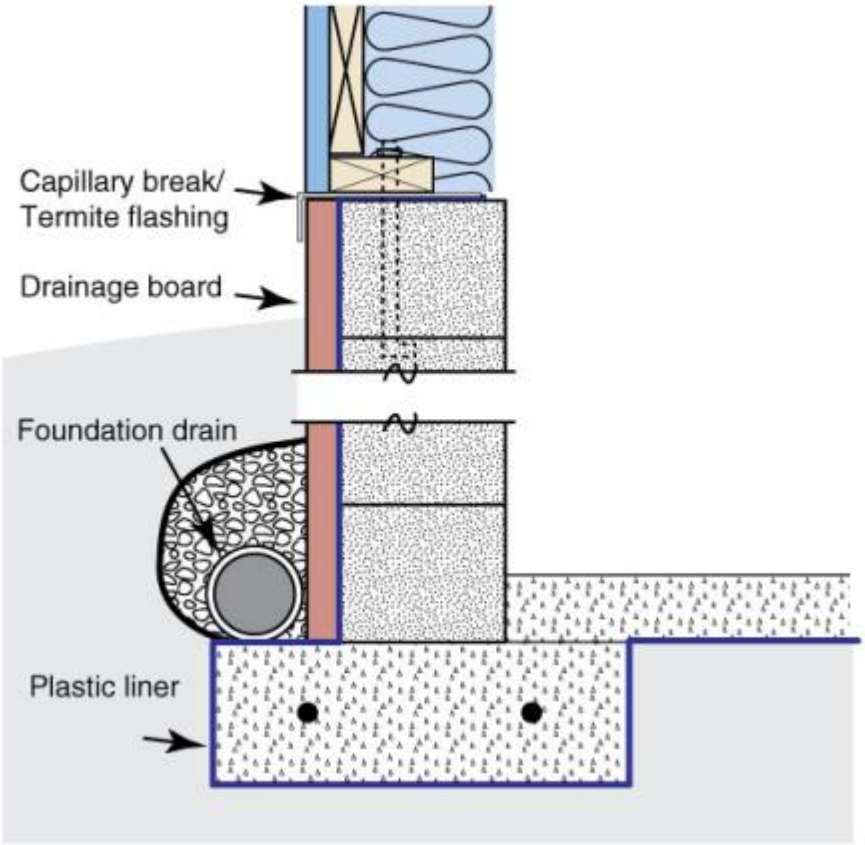


Figure 21: Foundation drain on top of footing

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 2.3 Patio slabs, walks and driveways sloped ≥1/4" per 1' away from building 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 2.4 Final site grade sloped ≥1/2" per 1' away from building 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 2.5 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 should 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.

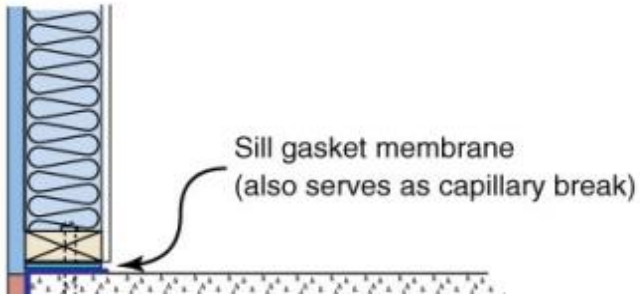
If high moisture was present

- 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 2.6 Capillary break between foundation and framing at exterior walls

Criteria

Install a capillary break between a concrete foundation wall/slab floor and sill plate. Install either a complete framed wall width sill gasket, EPDM-type rubber, sheet metal or other suitable membrane to prevent moisture from wicking through the foundation into the framing. Capillary break should be installed at all exterior wall locations.



Confirmation

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

DU 2.7 Drainage board and damp proofing for below-grade walls

Criteria

Apply damp proofing and 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 building.

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 the intent of this credit include but are not limited to:

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

Confirmation

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

DU 2.8 Design for or install additional dehumidification

Criteria

Rough in for, or install a whole-house dehumidifier as part of mechanical system to deal with elevated levels of humidity within dwelling units. For comfort, durability, and indoor air quality, recommended levels of relative humidity range from 40-50%.

1. ***Rough-in electrical and plumbing capacity for dehumidifier, to allow for dehumidification if necessary at a later date.***

2. ***Install whole-house ENERGY STAR dehumidifier as permanent part of the mechanical system.***

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 2.9 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.

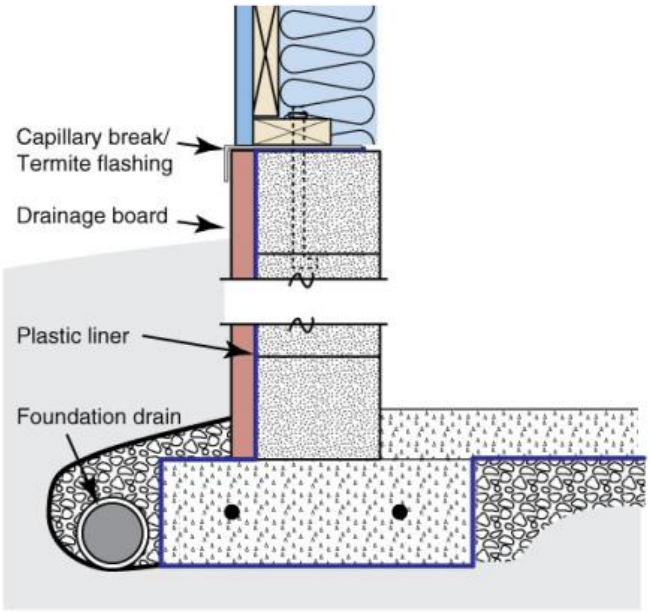


Figure 22: Foundation drain next to footing

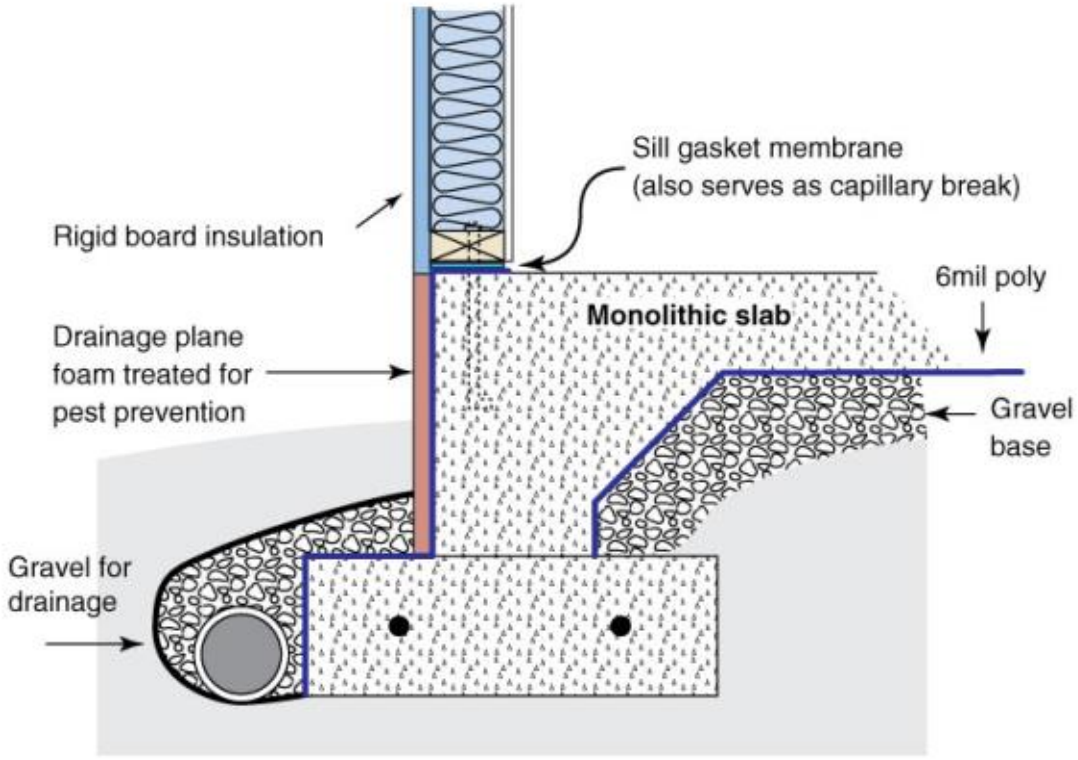


Figure 23: Foundation drain next to footing

Clarifications

If radon-resistant features are installed and drain tile discharges to daylight, install a check valve at the drain tile outfall.

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 2.10 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 2.11 Humidistat or thermidistat used with whole-house variable speed cooling system

Criteria

Install a humidistat or thermidistat used with an air handler equipped with a central variable speed blower on all heating and cooling equipment for moisture removal.

Clarifications

Equipment must be installed to maintain indoor relative humidity levels ≤60% relative humidity.

Confirmation

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

DU 2.12 Capillary break

Criteria

1. Between ground and footing or between footing and foundation

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.

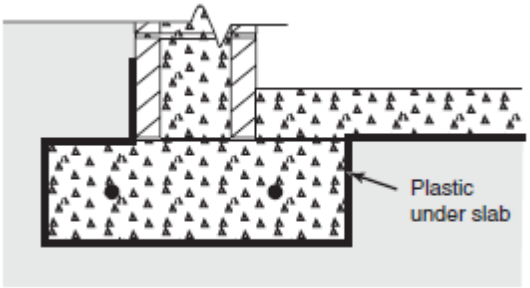


Figure 24: Capillary break between ground and footing

2. Between foundation and framing for all walls

Install a capillary break between a concrete foundation wall/slab floor and sill plate. Install either a complete framed wall width sill gasket, EPDM-type rubber, sheet metal or other suitable membrane to prevent moisture from wicking through the foundation into the framing. Capillary break should be installed between all foundations and sill plates, not just exterior walls.

Confirmation

Item 1

- 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.

Item 2

- 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 project teams can improve the health of occupants 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 No atmospherically vented water heaters or furnaces

Criteria
Do not install atmospherically venter water heater or furnaces

Clarifications
All combustion water heaters and furnaces shall be power or direct vented.

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

IAQ 1.2 Sealed-combustion or electric water heater must be installed in conditioned space

Criteria
Install gas water heater that has direct venting or power venting located within conditioned space.

OR

Install electric water heater.

Clarifications

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

Do not install atmospherically vented water heaters in conditioned space.

Confirmation

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

IAQ 1.3 Carbon monoxide detector (one per bedroom)

Criteria

Install one carbon monoxide (CO) detector per bedroom, if combustion appliances exist. If all bedrooms are on the same floor, install the CO detector in a central location near all bedrooms. 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.

Indoor Pollutant Control

IAQ 2.0 Protect all ducts until floor/wall finishing is complete

Criteria

All ducts (including those in floors, walls and ceilings) must be protected to prevent construction debris from entering ductwork.

Confirmation

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

IAQ 2.1 Filter(s) easily accessible for maintenance

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 filter. Filters located within the units (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.

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.

Filter doors should not be obstructed by any permanent fixtures including water heaters, washer and dryers, vents, condensate line or refrigerant line sets.

HVAC system design and installation must ensure accessible criteria are met.

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

IAQ 2.2 Provide rodent and corrosion proof screens with mesh ≤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 should use a flap damper to prevent rodent entry.

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

IAQ 2.3 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 EarthCraft Technical Advisor will visually confirm compliance with criteria at pre-drywall and final inspections.

IAQ 2.4 All interior paints have <100g/L VOC content

Criteria
Use only interior paints with a VOC content of <100g/L for common areas and for all units.

Confirmation
- The EarthCraft Technical Advisor will verify compliance with criteria at final inspection.
- The project team can submit product literature and order forms indicating compliance with the VOC content of interior paints.

IAQ 2.5 No carpet in below grade units

Criteria

Do not install carpet in any below grade units.

Confirmation

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

IAQ 2.6 Filters are ≥ MERV 6

Criteria

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.

Confirmation

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

IAQ 2.7 Certified low or no VOC materials

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
- Scientific Certification Systems (SCS) Standard EC-10.2-2007
- 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 or CRI Green Label Plus or has been tested and meets all the requirements of the CRI Green Label or CRI Green Label Plus testing program criteria.

5. Carpet pad

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.

6. Carpet pad adhesive

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

CRI Indoor Air Quality Carpet Testing Program: http://www.carpet-rug.org/residential-customers/selecting-the-right-carpet-or-rug/green-label-plus-carpet-list.cfm.

List of Green Label Plus qualifying carpet cushion: http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/green-label-cushion-list.cfm.

List of Green Label Plus qualifying carpet adhesives: http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/green-label-plus-adhesive-list.cfm.

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 2.8 Protect all bath fans until floor/wall finishing is complete

Criteria

Upon installation of all bath fans, seal all chases and openings to stop construction trash and dust from contaminating bath fan systems, and keep fans protected for the duration of construction.

Confirmation

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

IAQ 2.9 Flush building before occupancy

Criteria

Flush building 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 building, 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 buildings. Replace all filters after flushing building.

Confirmation

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

IAQ 2.10 No added urea-formaldehyde

Criteria

1. Insulation

Do not install insulation that contains added urea-formaldehyde.

2. Subfloor

Do not install subflooring that contains added urea-formaldehyde.

3. All cabinets, shelves, and countertops

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.

IAQ 2.11 Seal all particle board surfaces with water-based sealant

Criteria

Seal all particle board surfaces by coating all unsealed sides with water based polyurethane sealant or a formaldehyde sealant. Sealant must have a VOC (volatile organic compounds) content of 250 g/L or less.

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.

IAQ 2.12 No carpet in all units

Criteria

Do not install carpet in units on any floor.

Confirmation

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

IAQ 2.13 No Carpet in main living area of all units

Criteria

Do not install carpet in main living area of all units including areas adjacent to unit entrances.

Clarifications

If the project already achieves **IAQ 2.12. No carpet in all units,** the additional points are not attainable.

Confirmation

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

IAQ 2.14 Install permanent walk-off mats at each entry

Criteria

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

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 building 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 buildings 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

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

In the case of a commercial construction type, the project must comply with the appropriate version of ASHRAE 90.1. This code will be in reference to commercial construction with a residential use. Projects such as these will be required to follow the mid-rise/high-rise energy simulation requirements detailed in section "BE 0.2" and "BE 0.3".

Clarifications

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

Additional Resources

An electronic copy of the 2009 IECC is available through the International Codes Council, www.iccsafe.org.

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

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

BE 0.2 Energy Compliance: CERTIFIED LEVEL

Criteria

a. Low-Rise Multifamily:

For CERTIFIED projects complete worst case unit level energy models based on actual construction and demonstrate a confirmed HERS Rating Index that is less than or equal to 80.

b. Mid-Rise/High-Rise Multifamily:

For CERTIFIED projects complete a building level simulation (eQUEST) based on actual construction and demonstrate compliance with ENERGY STAR Multifamily High Rise energy goals, including a 15% improvement over ASHRAE 90.1-2007.

c. Adaptive Reuse Projects:

For CERTIFIED projects complete worst case unit level energy models based on actual construction and demonstrate a confirmed HERS Rating Index that is less than or equal to 80.

OR

For CERTIFIED Mid-Rise/High-Rise Multifamily projects complete a building level simulation (eQUEST) based on actual construction and demonstrate compliance with ENERGY STAR Multifamily High Rise energy goals, including a 15% improvement over ASHRAE 90.1-2007.

Clarifications

Low-Rise residential:
- Units in buildings with ≤4 total units
- Units in buildings with ≤3 stories
- Units in buildings with 4-5 stories, in unit HVAC & DHW systems, AND ≤20% common space (as percentage of overall building square footage).

Mid-Rise/High-Rise Residential:
- Multifamily buildings with ≥5 total units
- Multifamily buildings with ≥ 6 stories
- Multifamily buildings with 4-5 stories, with central systems (HVAC or DHW), or >20% common space (as percentage of overall building square footage).

Please contact EarthCraft Virginia for further clarification on whether the project should follow low-rise or mid-rise/high-rise requirements.

Adaptive Reuse:

Any project changing transforming a building from a previously non-residential use. This may include warehouses, hotels, gyms, school buildings, or other similar types. The adaptive reuse may be historic in nature.

Additional Resources

More information on ENERGY STAR New Homes may be found at www.energystar.gov.

Confirmation
When seeking Certified Level Compliance:
- The EarthCraft Technical Advisor will develop an energy model in accordance with RESNET modeling criteria and confirm compliance with criteria at pre-drywall and final inspections.
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to pre-drywall inspections.

BE 0.3 Energy Compliance: GOLD or PLATINUM

Criteria

A. Low-Rise Multifamily:

For GOLD or Platinum projects complete worst case unit level energy models based on actual construction and demonstrate a confirmed HERS Rating Index that is less than or equal 75.

B. Mid-Rise/High-Rise Multifamily:

GOLD or PLATINUM High-Rise projects must achieve full certification in the ENERGY STAR Multifamily High Rise program in either the Performance or Prescriptive path.

For GOLD or PLATINUM projects complete a building level simulation (eQUEST) based on actual construction and demonstrate compliance with ENERGY STAR Multifamily High Rise energy goals including a 15% improvement over ASHRAE 90.1-2007.

C. Adaptive Reuse Projects:

For GOLD or PLATINUM projects complete worst case unit level energy models based on actual construction and demonstrate a confirmed HERS Rating Index that is less than or equal 75.

OR

For GOLD or PLATINUM Mid-Rise/High-Rise projects complete a building level simulation (eQUEST) based on actual construction and demonstrate compliance with ENERGY STAR Multifamily High Rise energy goals, including a 15% improvement over ASHRAE 90.1-2007.

Clarifications

Low-Rise residential:
- Units in buildings with ≤4 total units
- Units in buildings with ≤3 stories
- Units in buildings with 4-5 stories, in unit HVAC & DHW systems, AND ≤20% common space (as percentage of overall building square footage).

Mid-Rise/High-Rise Residential:
- Multifamily buildings with ≥5 total units
- Multifamily buildings with ≥ 6 stories
- Multifamily buildings with 4-5 stories, with central systems (HVAC or DHW), or >20% common space (as percentage of overall building square footage).

Please contact EarthCraft for further clarification on whether the project should follow low-rise or mid-rise/high-rise requirements.

Adaptive Reuse:

Any project changing transforming a building from a previously non-residential use. This may include warehouses, hotels, gyms, school buildings, or other similar types. The adaptive reuse may be historic in nature.

Additional Resources

More information on ENERGY STAR New Homes may be found at www.energystar.gov.

Confirmation

When seeking GOLD or PLATINUM Level Compliance:

- The EarthCraft Technical Advisor will develop an energy model in accordance with RESNET modeling criteria and confirm compliance with criteria at pre-drywall and final inspections.
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to pre-drywall inspections.

Air Sealing

BE 1.0 Install vapor barriers only under slabs and on crawlspace floors and not on any vertical surfaces

Criteria

No polyethylene or other materials with a perm rating ≤0.1, such as vinyl wall paper, may be used on foundation or above grade walls, or in any other assembly except under slabs and on crawlspace 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 with criteria at pre-drywall inspection.

BE 1.1 Seal bottom plates to subfloor or foundation for entire unit envelope

Criteria

Using the appropriate sealant, seal the bottom plates of walls separating conditioned and unconditioned spaces to subfloor or foundation, including the bottom plate to subfloor connections in garage.

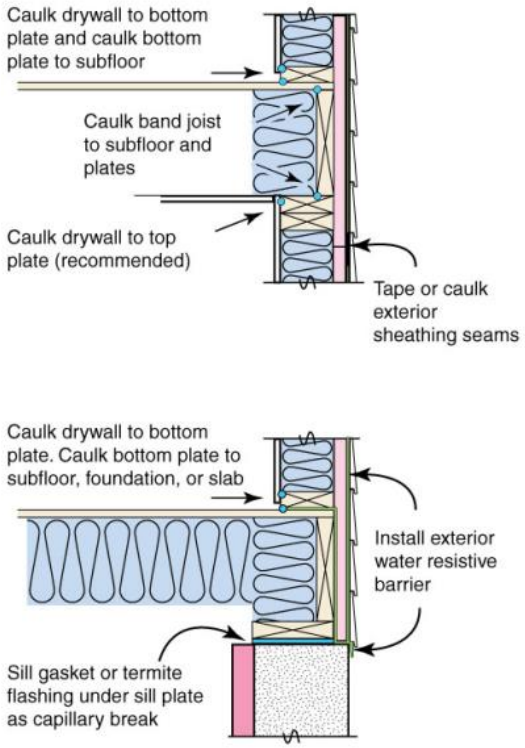


Figure 25: Sealed bottom plates

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 with criteria at pre-drywall inspection.

BE 1.2 Block and seal joist cavities

Criteria

1. 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.

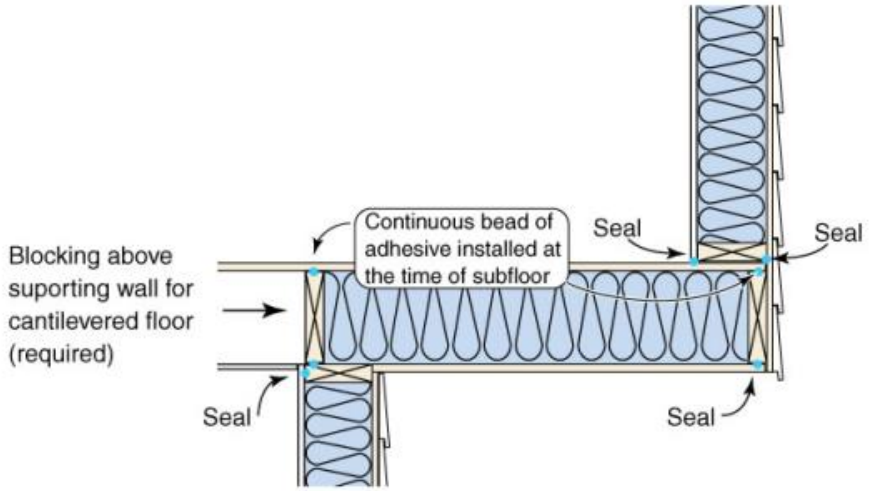


Figure 26: Cantilevered floor blocking

2. 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.

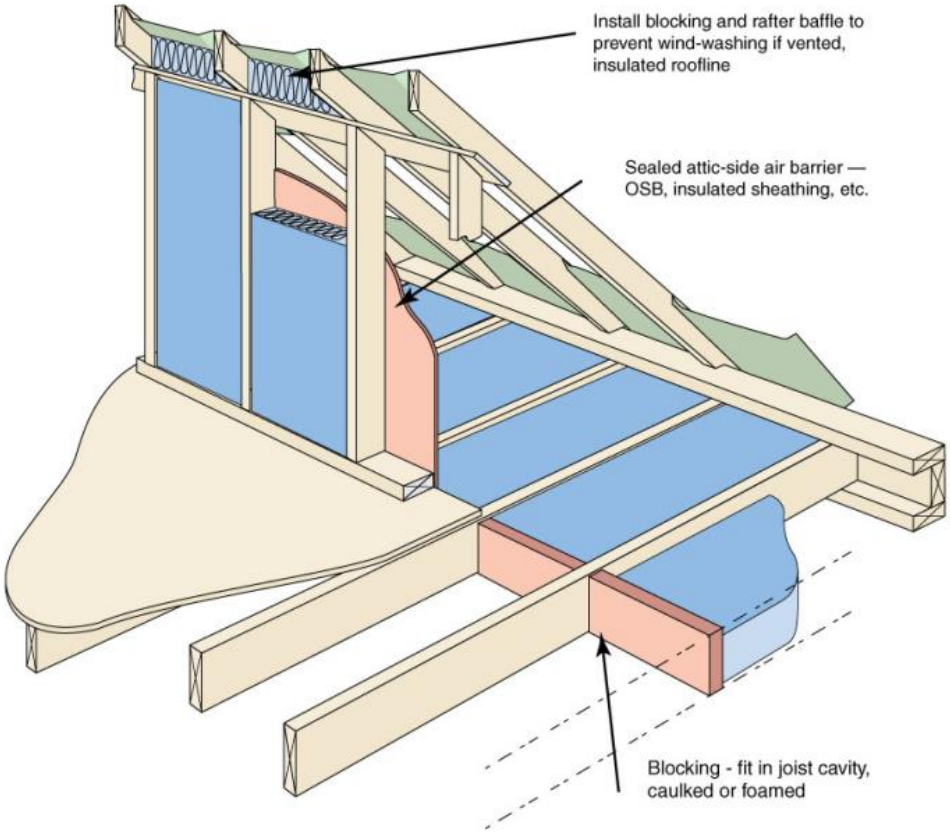


Figure 27: Attic kneewall blocking

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.

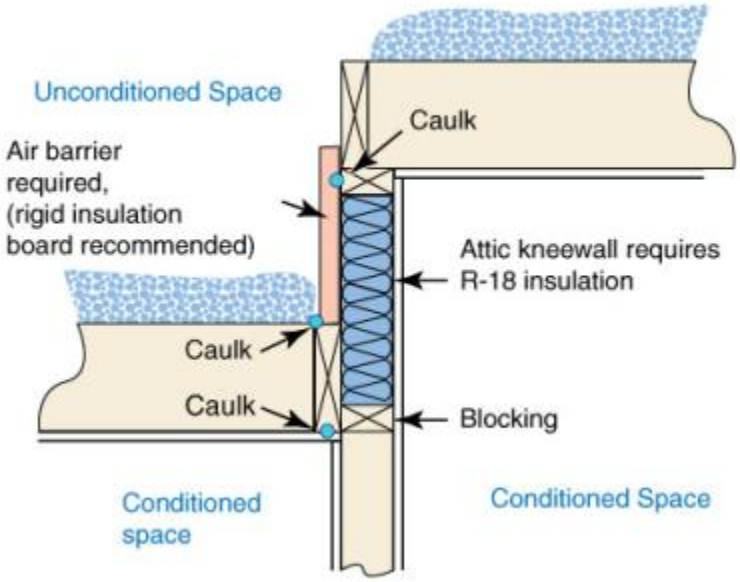


Figure 28: Blocking at change in ceiling height

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 attics

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.

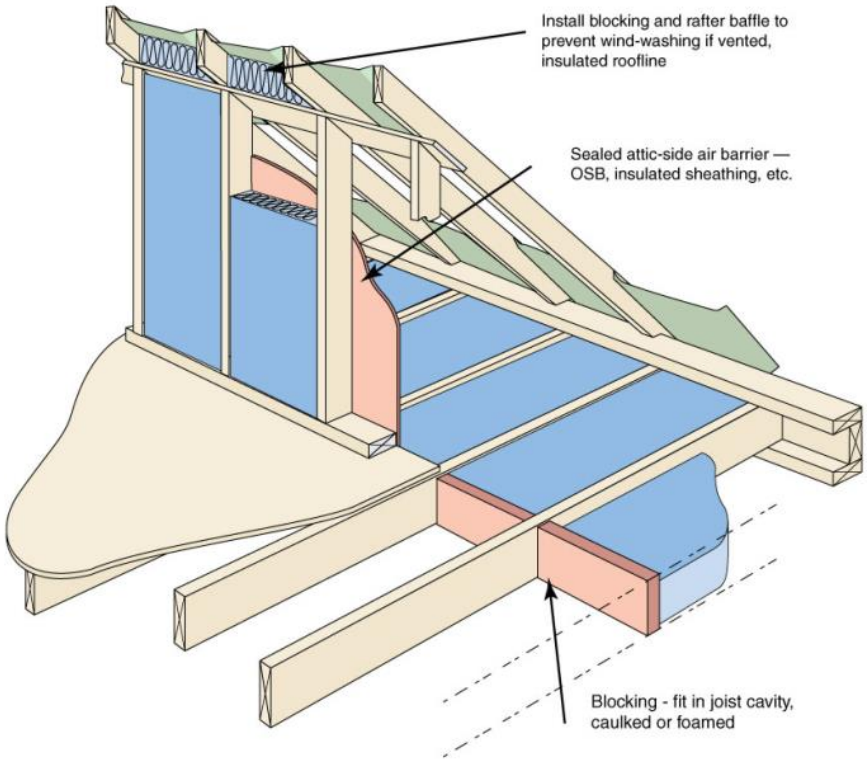


Figure 28: Attic kneewall blocking

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 plate

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.

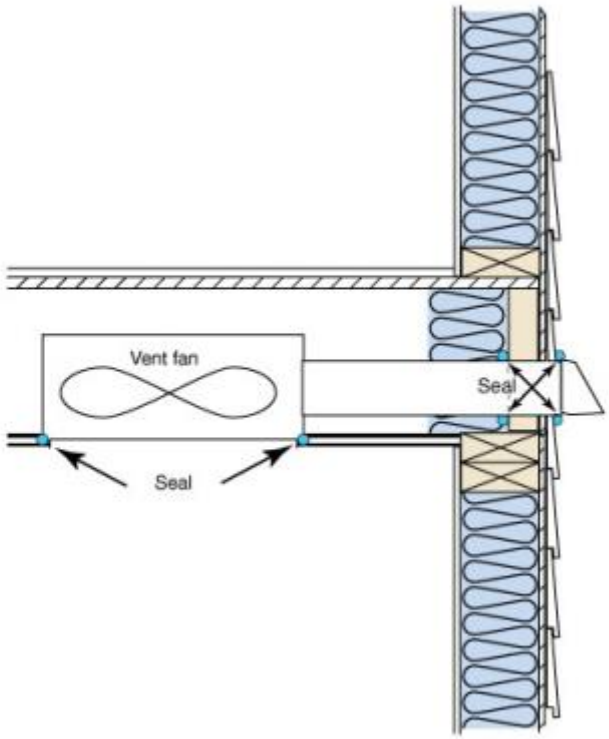


Figure 29: Bath fan vent sealed at rim joist

4. Insulated subfloor

Seal all penetrations (e.g. HVAC, plumbing and electrical) through insulated floor systems over unconditioned areas such as vented crawlspaces, unconditioned basements and garages.

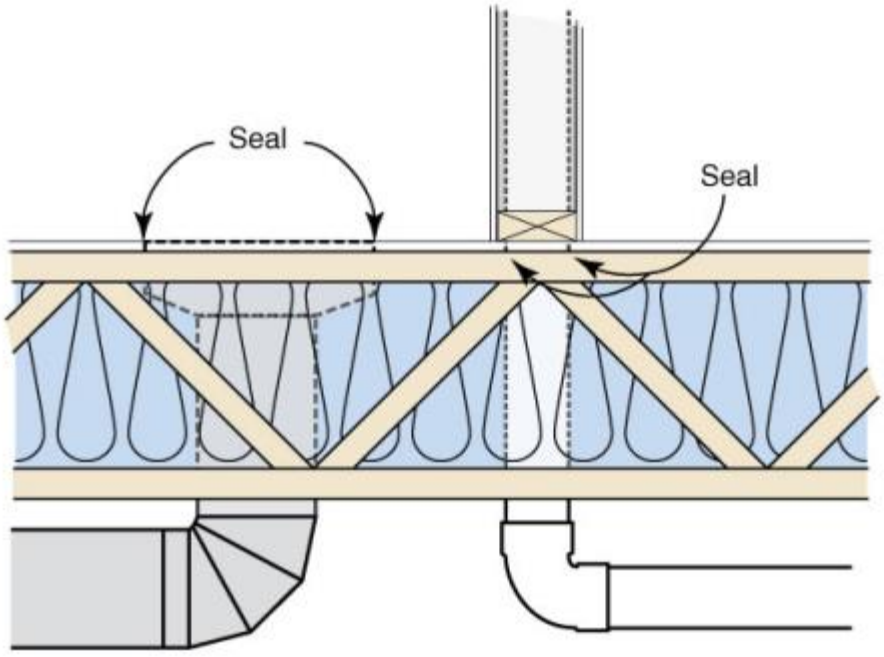


Figure 30: Air sealing at insulated subfloor

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. All ceilings

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

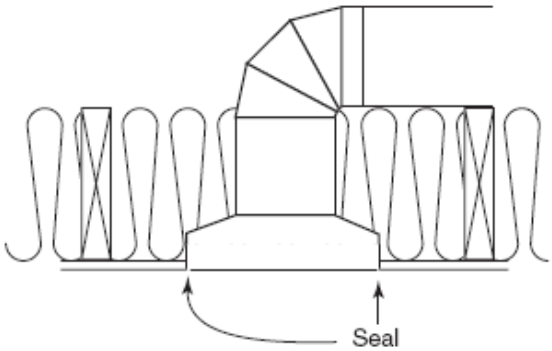


Figure 31: Air sealing at HVAC boot in insulated ceiling

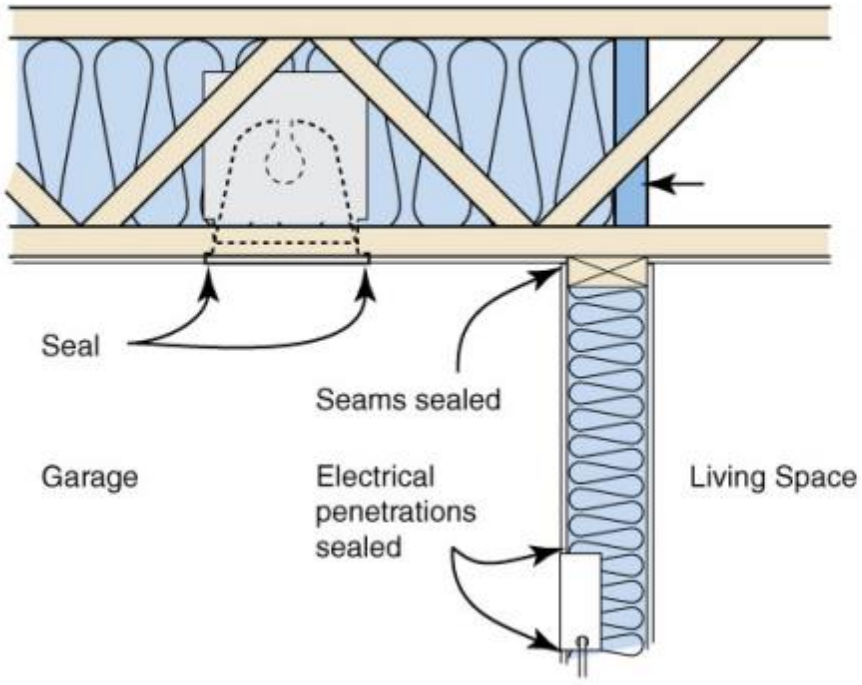


Figure 32: Air sealing at can light

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, sinks, toilets 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.

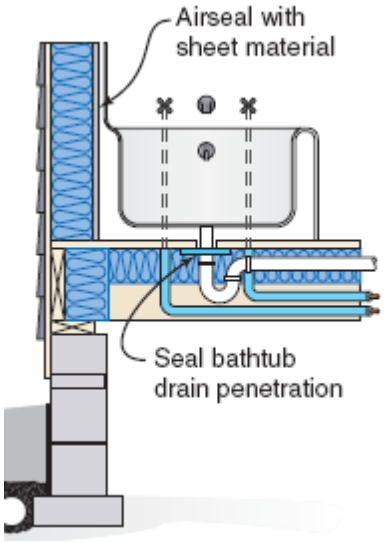


Figure 33: Air sealing at plumbing penetration in subfloor

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.

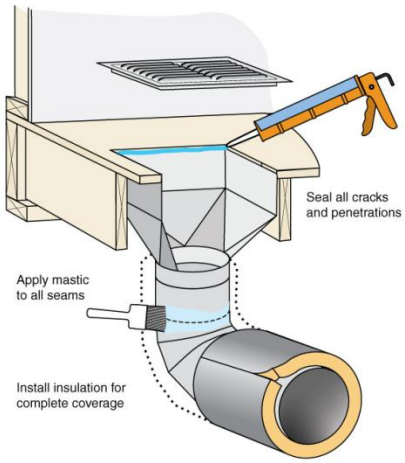


Figure 34: Sealing boot to subfloor

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.

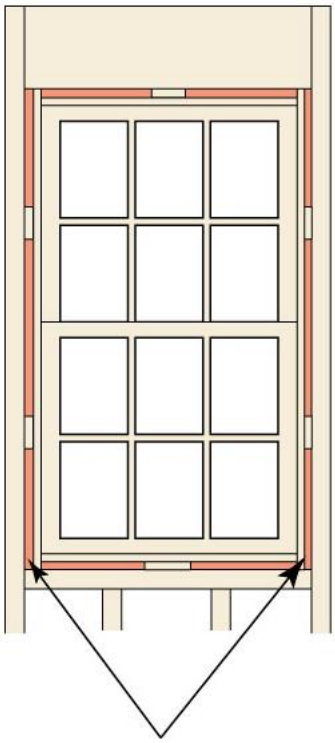


Figure 35: Air sealing around window and door rough openings

4. All drywall penetrations (common walls between attached units included)

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.

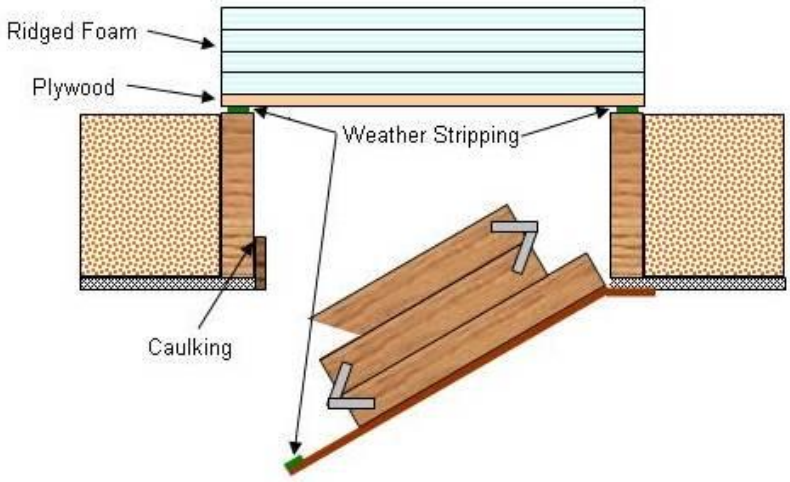


Figure 36: Attic pull-down stairs with foam board

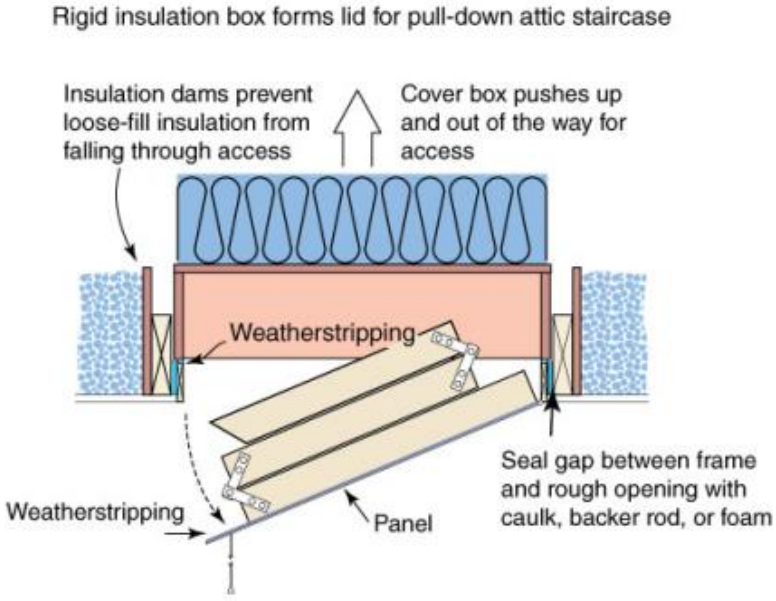


Figure 37: Attic pull-down stairs with batt insulation

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.

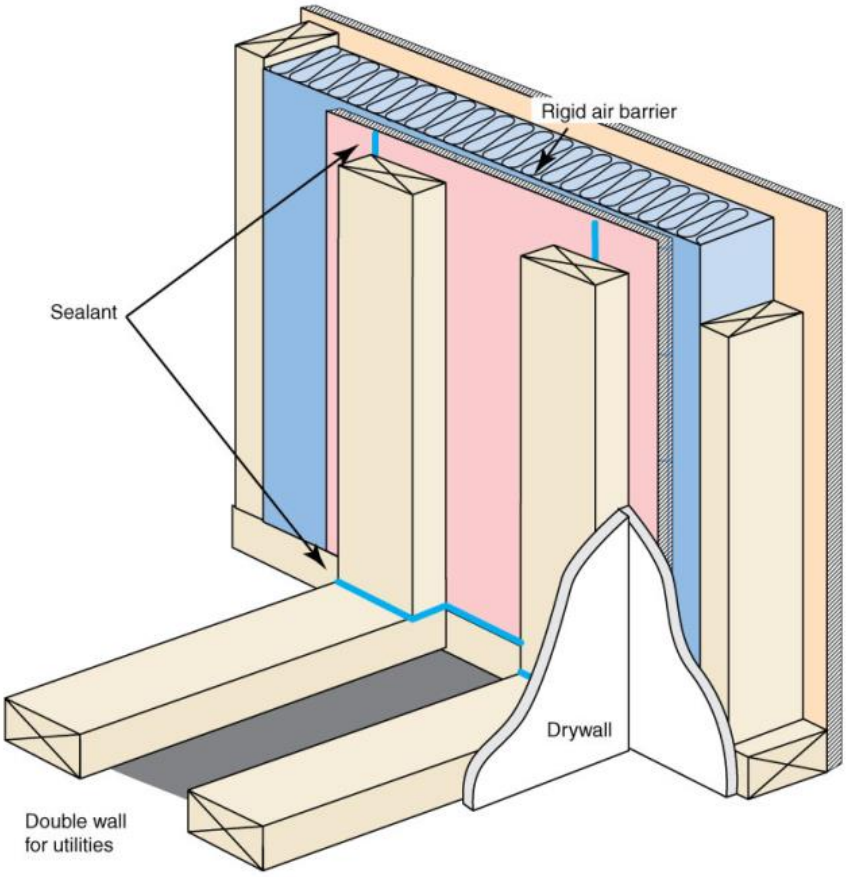


Figure 38: Rigid air barrier at chase on insulated wall

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 should be sealed to top plate, subfloor and at butt joints, or at exterior sheathing.

2. *Exterior wall sheathing*

Seal all gaps ≥⅛" 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.

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.

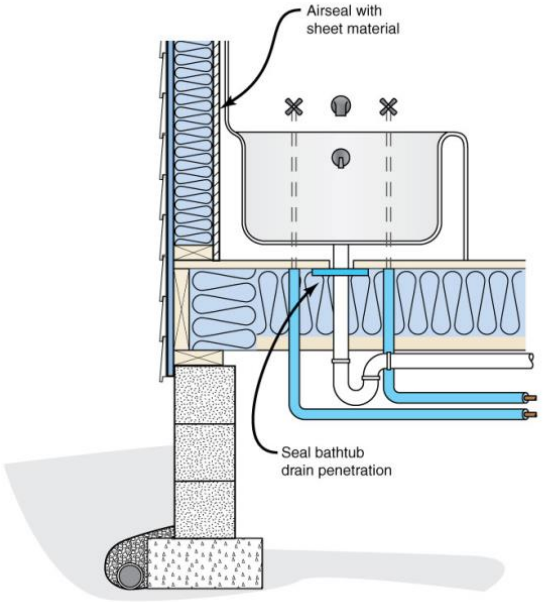


Figure 39: Air barrier behind tub

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 should include areas under enclosed landings and bottom stairs.

5. Along porch roofs

Seal and insulate all porch roofs at the vertical connection between the conditioned interior of the dwelling unit 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.

7. At all band joists above unit separation walls

Using appropriate sealant, seal and insulate all band joists above unit separation walls.

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 projects 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.

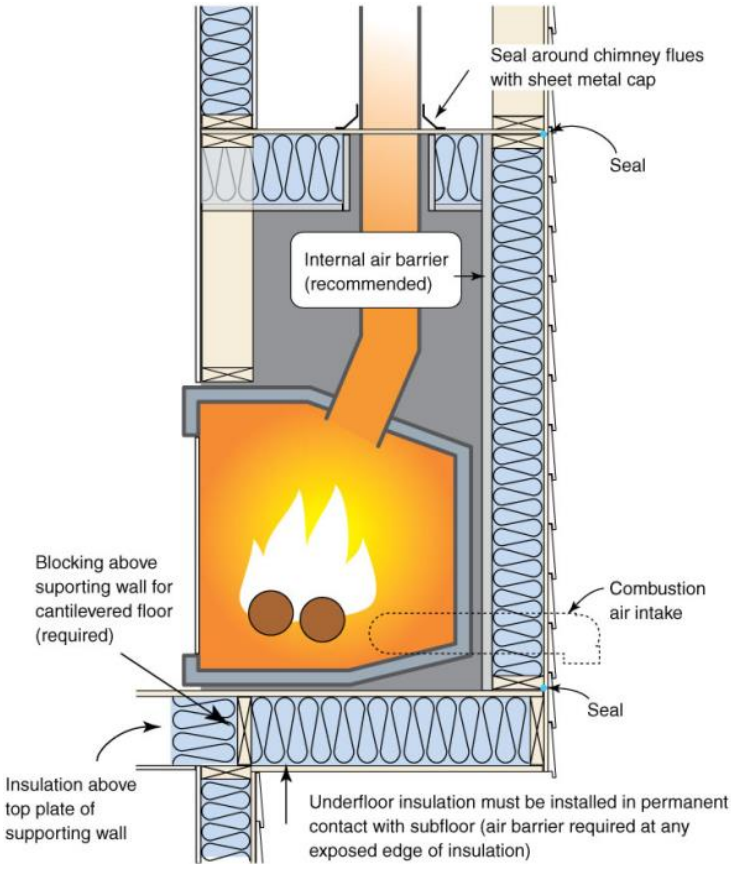


Figure 40: Insulated fireplace chase

Exemptions

For Climate Zones 2-3, projects 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 (if not included in door assembly)

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.

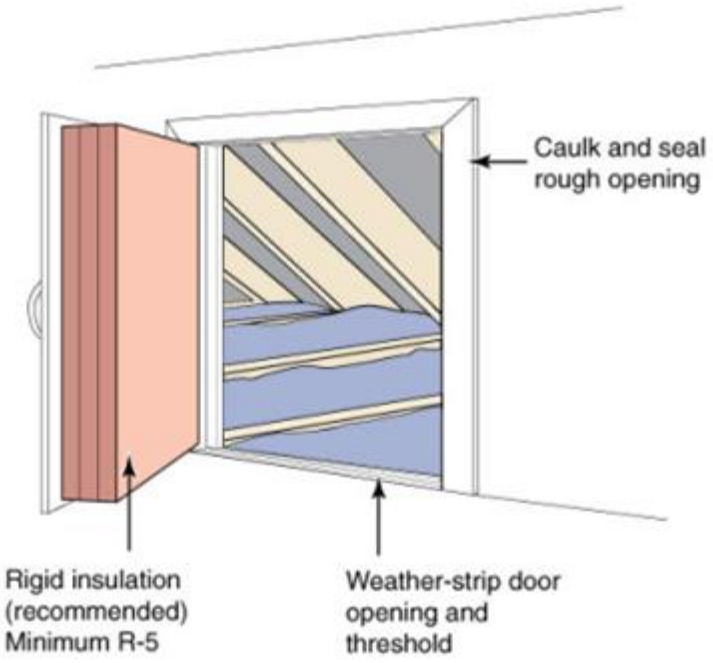


Figure 41: Kneewall door weather-stripping

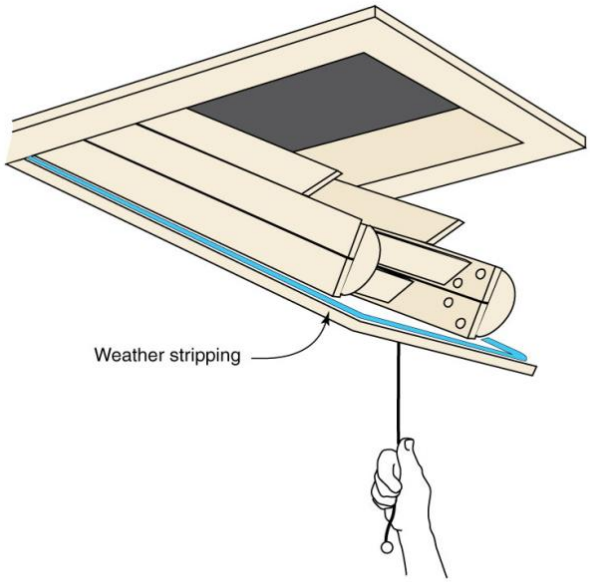


Figure 42: Pull-down stairs weather-stripping

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 ≥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.

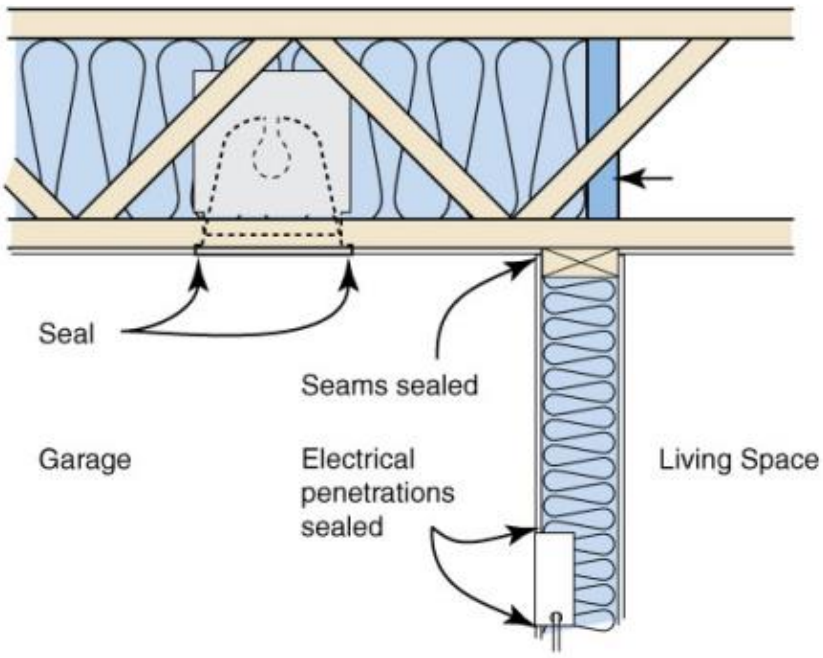


Figure 43: Can light installation

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

BE 1.11 Fire rated assemblies that do not use draft block in band areas must comply with Air Tight Drywall approach

Criteria

Use an airtight drywall (ATD) approach to reduce air infiltration rates. Airtight drywall will qualify when a gasket or caulk is applied at all top plates at all exterior walls, interior partition walls, and unit separation walls. On bottom-floor or middle-floor units without gypcrete application, the gasket and caulk application will be required on all bottom plates at exterior walls, interior partition walls, and unit separation walls. All interior wall penetrations must be air sealed in walls and ceilings (including all fixtures and receptacle boxes).

Clarification:

Airtight drywall is required on projects that do not utilize **fire blocking** in the floor systems above tenant separation walls.

The ATD approach will reduce the unit envelope leakage in these circumstances in order to achieve the required envelope leakage goals. Projects that forego ATD in these locations and fail to reach the envelope leakage goals will not be eligible for ECMF certification.

See **ECMF Common Obstacles** Addendum for additional solutions for these locations.

Caulk or gaskets are acceptable applications, but liquid nails or other adhesives are not suitable for ATD applications.

Confirmation
- The EarthCraft Technical Advisor will visually confirm ATD compliance during drywall installation and at final inspections.

BE 1.12 Units adjacent to fire walls or CMU walls with an air gap assembly must follow Air Tight Drywall approach

Criteria

Use an airtight drywall (ATD) approach to reduce air infiltration rates. Airtight drywall will qualify when a gasket or caulk is applied at all top plates at all exterior walls, interior partition walls, and unit separation walls. On bottom-floor or middle-floor units without gypcrete application, the gasket and caulk application will be required on all bottom plates at exterior walls, interior partition walls, and unit separation walls. All interior wall penetrations must be air sealed in walls and ceilings (including all fixtures and receptacle boxes).

Clarification:

Airtight drywall is required on projects with units adjacent to **fire walls or CMU walls** with an air gap as part of the required assembly.

The ATD approach will reduce the unit envelope leakage in these circumstances in order to achieve the required envelope leakage goals. Projects that forego ATD in these locations and fail to reach the envelope leakage goals will not be eligible for ECMF certification.

See **ECMF Common Obstacles** Addendum for additional solutions for these locations.

Caulk or gaskets are acceptable applications, but liquid nails or other adhesives are not suitable for ATD applications.

Confirmation
- The EarthCraft Technical Advisor will visually confirm ATD compliance during drywall installation and at final inspections.

BE 1.13 Seal top plate to drywall at the attic level

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.

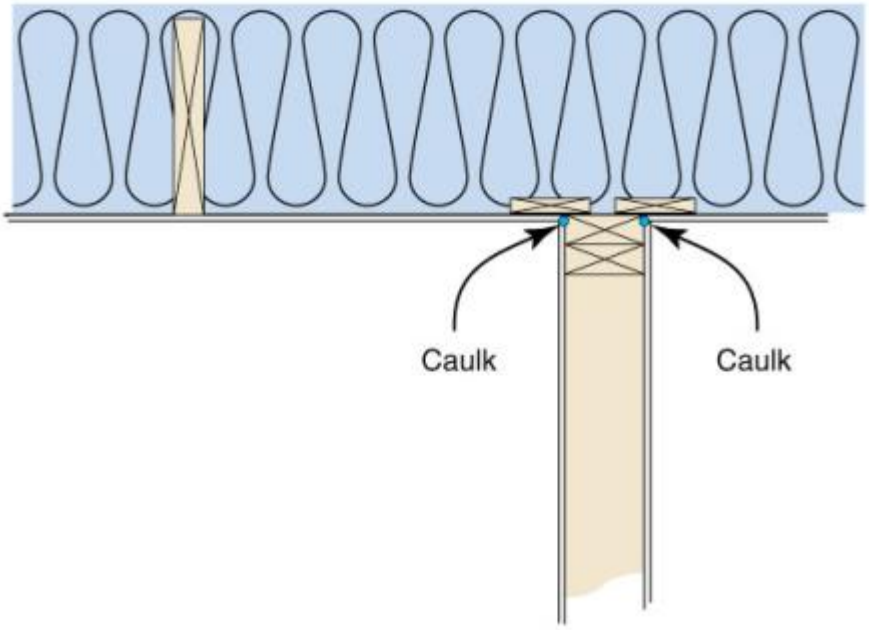


Figure 44: Top plate sealed

Clarifications
Construction adhesive is not permitted as sealant.

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

BE 1.14 Comply with Air Tight Drywall approach

Criteria
Use an airtight drywall (ATD) approach to reduce air infiltration rates. Airtight drywall will qualify when a gasket or caulk is applied at all top plates at all exterior walls, interior partition walls, and unit separation walls. On bottom-floor or middle-floor units without gypcrete application, the gasket and caulk application will be required on all bottom plates at exterior walls, interior partition walls, and unit separation walls. All interior wall penetrations must be air sealed in walls and ceilings (including all fixtures and receptacle boxes).

Highly Recommended:
Airtight drywall is recommended on projects that do not utilize **fire blocking** in the floor systems above tenant separation walls and in dwelling units adjacent to **fire walls or CMU walls** with an air gap as part of the required assembly.

The ATD approach will reduce the unit envelope leakage in these circumstances in order to achieve the required envelope leakage goals **(BE 2: Envelope Leakage Ratio).** Projects that choose to forego ATD in these locations and fail to reach the envelope leakage goals will not be eligible for ECMF certification.

See **ECMF Common Obstacles** Addendum for additional solutions for these locations.

Clarification
Caulk or gaskets are acceptable applications, but liquid nails or other adhesives are not suitable for ATD applications.

Confirmation
- The EarthCraft Technical Advisor will visually confirm ATD compliance during drywall installation and at final inspections.

BE 1.15 Gypcrete on all framed floors separating unit envelopes

Criteria
Apply gypcrete in space between tenant separation walls or any dead cavities existing between units or between units and common areas.

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

BE 1.16 Two-pour application of gypcrete include areas blocked by drywall

Criteria
Apply an additional application of gypcrete in areas otherwise blocked by drywall. Such areas will include space beneath tubs, chases, dead spaces between adjacent units and units and common areas.

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

BE 1.17 Firewalls/party walls that eliminate air gap (UL 370 or equivalent)

Criteria
Approved assemblies that do not utilize an air gap will qualify.

Confirmation
- Project team must supply plan details on the qualifying system.
- The EarthCraft Technical Advisor will visually confirm at pre-drywall inspections.

BE 1.18 No recessed can lights installed

Criteria
Do not install any recessed can lights in units.

Confirmation
- The EarthCraft Technical Advisor will visually confirm.

Blower door test

Criteria
A blower door test is required for all EarthCraft projects. Various levels of tightness are needed for each level of certification.

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.

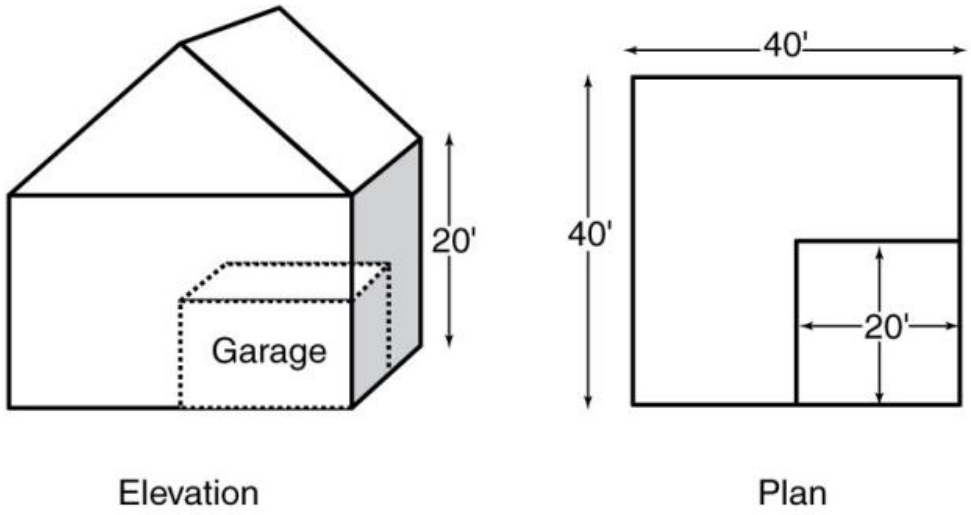


Figure 45: Sample floor plan

CALCULATION: $cfm_{50 * 60}$ / Volume = ACH_{50}

BLOWER DOOR TEST RESULT: 2,000 cfm at 50 Pa pressure (2,000 cfm_{50})

For the above referenced home VOLUME = 1200 ft. sq. * 10 + 1600 ft. sq. *10 = 28,000 cu. Ft.

2,000 cfm50 * 60 / 28,000 cu. Ft. = 4.28 ACH_{50}

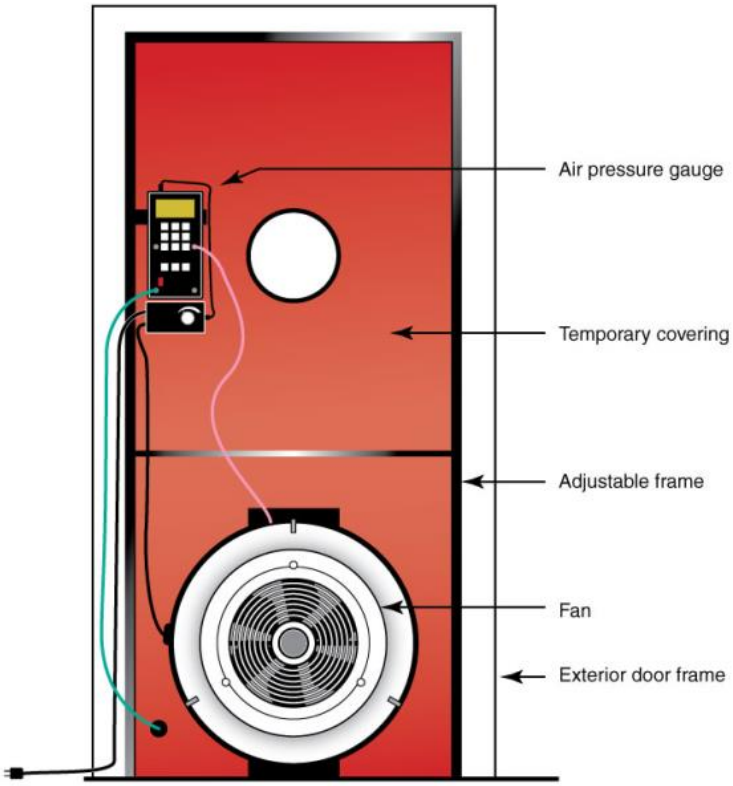


Figure 46: Blower door

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

BE 2.0 Air Changes per Hour ≤ 5 ACH_{50}

Criteria

The envelope infiltration rate must be ≤ 5 ACH_{50} to meet the minimum certification requirements

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

BE 2.1 Air Changes per Hour ≤ 4 ACH_{50}

Criteria

The envelope infiltration rate must be ≤ 4 ACH_{50} to achieve the Platinum and Gold certification level.

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

BE 2.2 Air Changes per Hour ≤ 3 ACH_{50}

Criteria

The envelope infiltration rate must be ≤ 3 ACH_{50}

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.

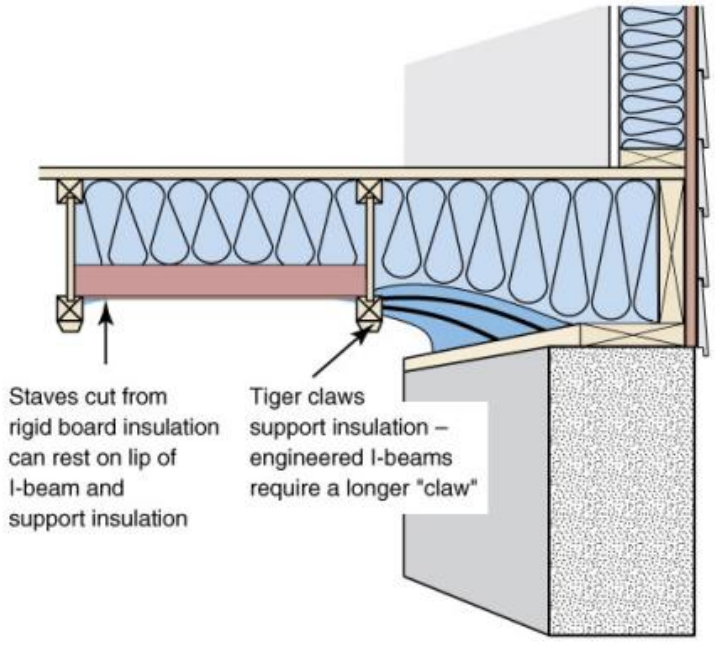


Figure 47: Floor insulation supports

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.

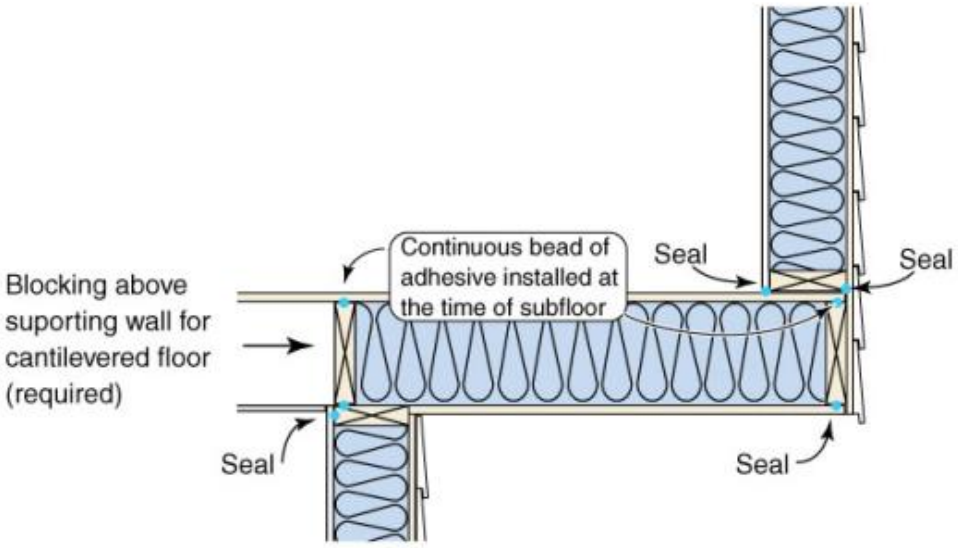


Figure 48: Cantilevered floor insulation

3. Podium/elevated slabs ≥ R-19

Insulate podiums or elevated slabs over 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.

Clarifications

Framed floors over basement/crawlspace require insulation only 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 with criteria at pre-drywall and final inspections.

BE 3.1 Walls

Criteria

1. Exterior walls and band joist ≥R-13

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. Elevator walls adjacent to dwelling units ≥R-13

Install insulation on elevator walls adjacent to dwelling units ≥R-13. Cut batts in narrow cavities and around plumbing and wiring to fit per manufacturer's specifications, or fill narrow cavities with sprayed/blown insulation.

3. Foundation walls ≥R-10 continuous or ≥R-13 cavity

Insulate foundation walls in Climate Zone 4 to minimum R-10 continuous or R-13 cavity insulation.

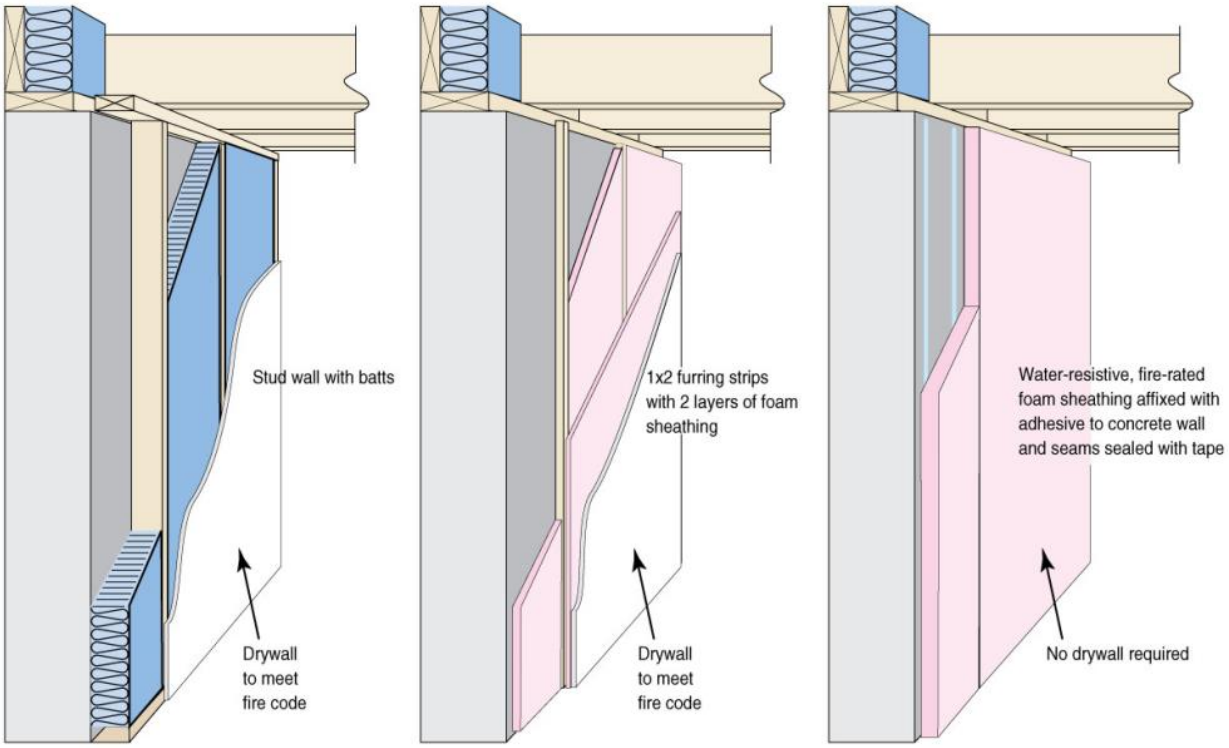


Figure 49: Foundation wall insulation

Clarifications

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/Roof

Criteria

1. Vented Flat: Climate Zone 4 ≥ R-38

Install insulation ≥R-38 in Climate Zone 4. Continue full depth of insulation over perimeter top plates.

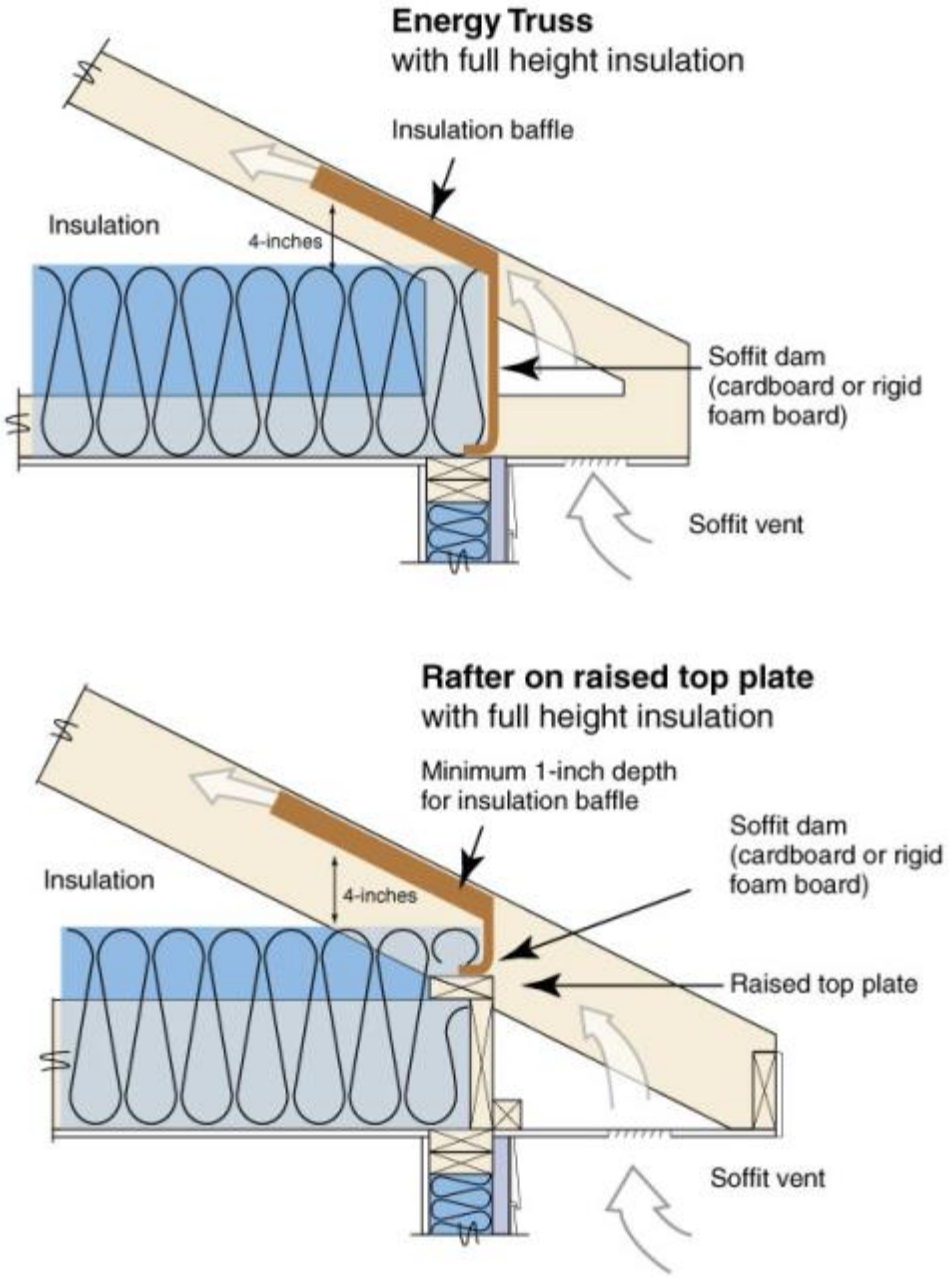


Figure 50: Full insulation over top plate

2. Continuous Roof Deck: Climate Zone 4 ≥ R-20

For roofs with continuous insulation located entirely above deck, insulate to ≥ R-20

3. Sloped: Climate Zone 4 ≥R-38

In sloped ceilings with attic above, 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-38 in Climate Zone 4.

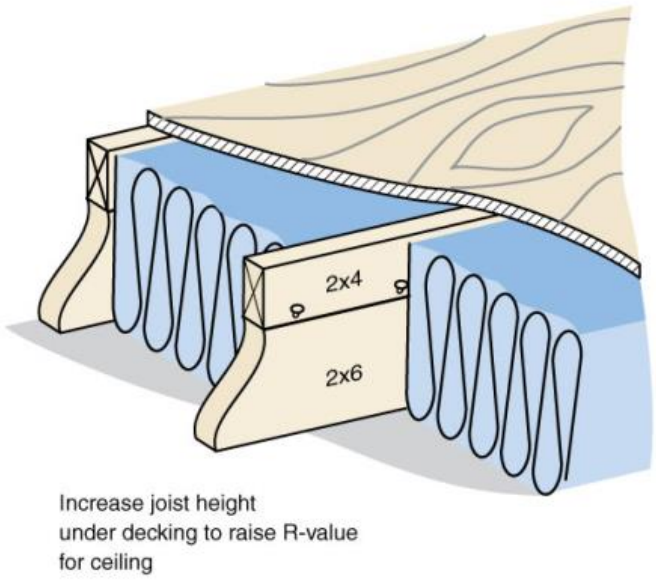


Figure 51: Raised joist to accommodate for insulation under attic platform

Sloped ceilings with ambient above (e.g., cathedral ceilings) are not addressed under this criteria and should 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.

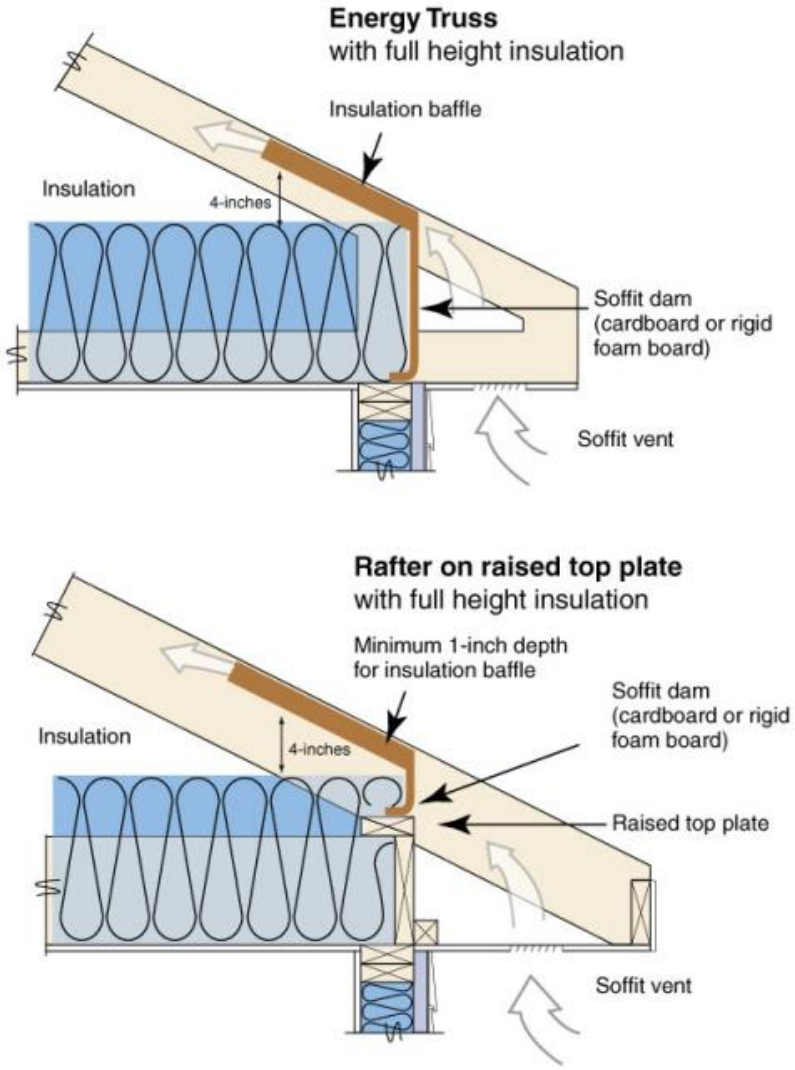


Figure 3: Energy heel truss (top), raised top plate (bottom)

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 4 ≥R-19*

Insulate doors separating conditioned space from unconditioned attic spaces to 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 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 Zone 4.

Insulation must be in contact with attic side air barrier.

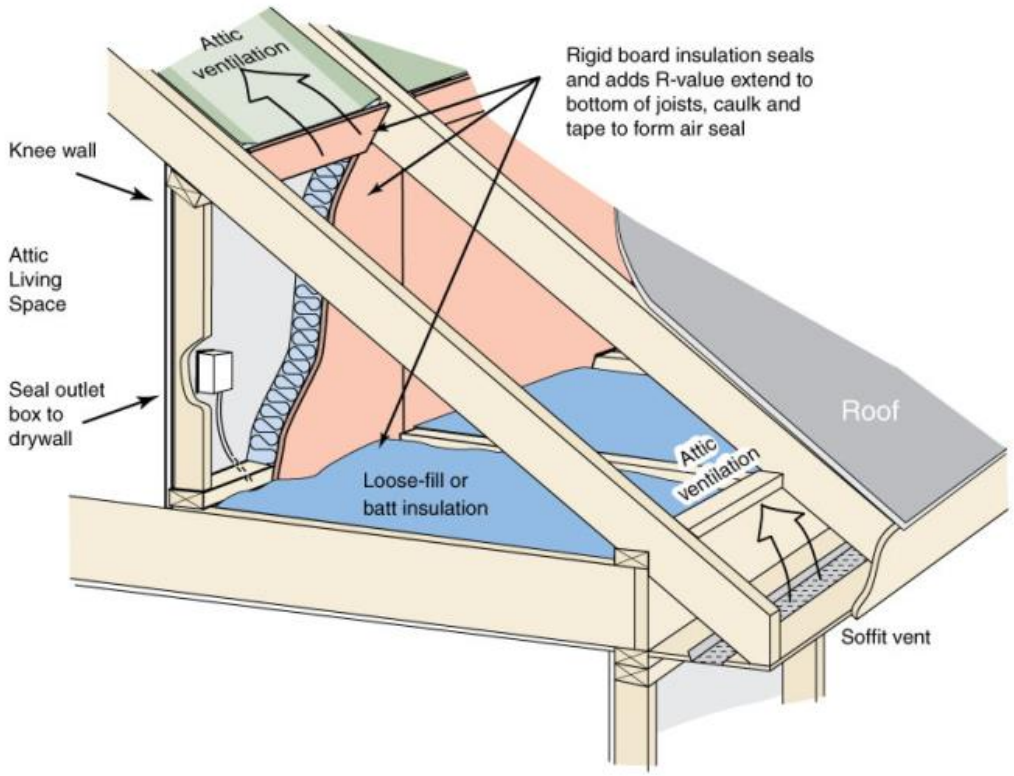


Figure 53: Attic kneewall insulation and blocking

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 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-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-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 loose-fill attic insulation, install card and rulers

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 3.7 Steel-framed buildings require thermal break ≥ R-7.5

Criteria

All steel-framed buildings must be insulated with continuous exterior insulation greater than or equal to R-7.5

Confirmation

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

BE 3.8 Grade II insulation quality at all building envelope locations

Criteria

Install insulation per manufacturer's recommendations to achieve quality Grade II as specified by criteria set forth by RESNET. All insulation must meet or exceed Grade II installation quality regardless of location in building.

Additional Resources

For more details on 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 with criteria at pre-drywall and final inspections.

BE 3.9 Slab edge insulation: Climate Zone 4 ≥R-10

Criteria

Install exterior slab insulation, 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.

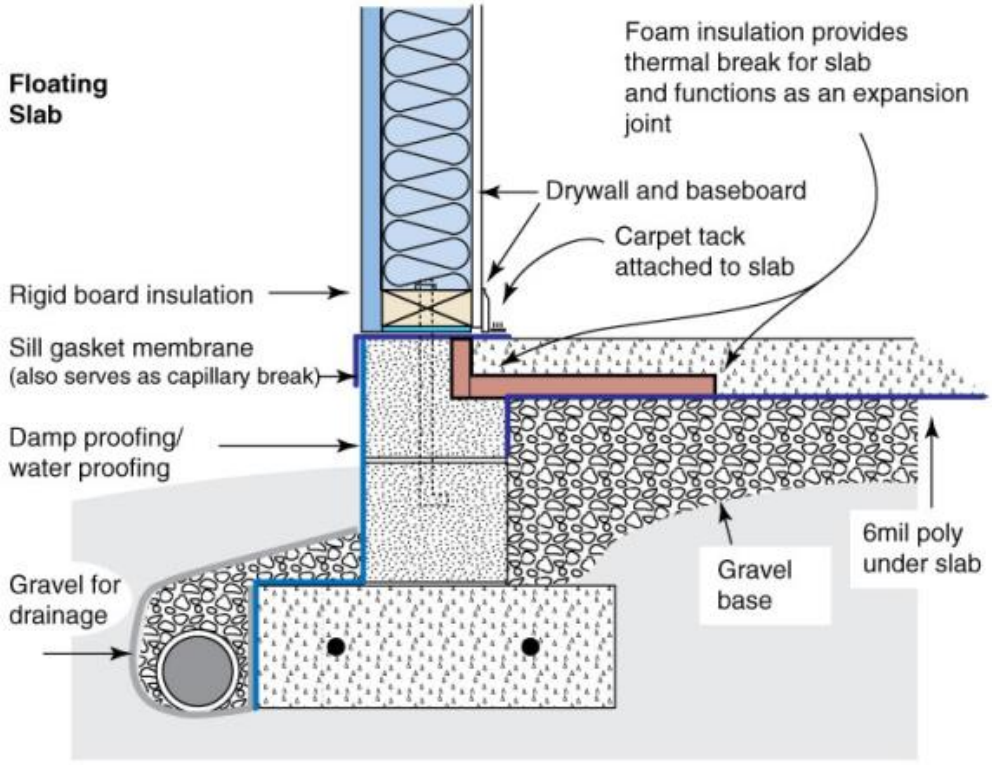


Figure 54: Slab edge insulation for floating slab

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 3.10 Exterior band areas have interior air barrier meeting required insulation values

Criteria

All exterior band areas must have an air barrier product applied to the interior side of the wall framing. One method to achieve this would include the application of a spray foam product to serve as insulation and an air barrier.

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

BE 3.11 Insulation installation quality (floors, walls and ceilings)

Criteria

A. Grade I

Install insulation per manufacturer's recommendations to achieve insulation quality Grade I as specified by criteria set forth by RESNET for all floors, walls and ceilings.

B. Grade II with insulated sheathing ≥ R-3 (100%)

Install insulation with insulated sheathing ≥ R-3 on 100% of the building per manufacturer's recommendations to achieve insulation quality Grade II as specified by criteria set forth by RESNET for all floors, walls and ceilings. For steel-framed walls, the insulation must reach R-7.5 continuous insulation or greater.

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

BE 3.12 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.

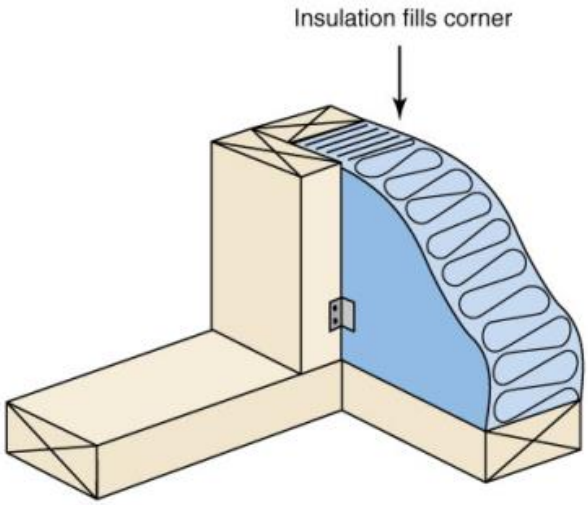


Figure 55: Insulated corner

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 with criteria at pre-drywall inspection.

BE 3.13 Headers ≥R-3

Criteria

Insulate all headers on walls separating conditioned and unconditioned space to greater than or equal to R-3.

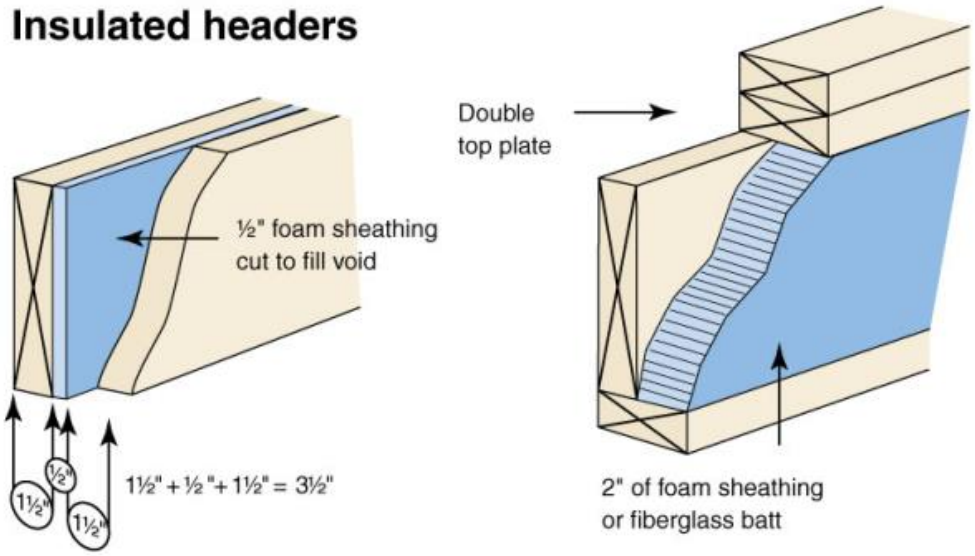


Figure 56: Insulated headers

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 with criteria at pre-drywall inspection.

BE 3.14 Fiberglass batts are unfaced/friction fit

Criteria

Apply unfaced batt insulation to all exterior wall assemblies and use friction fit installation techniques between studs and joists.

Confirmation

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

BE 3.15 Insulate with foam applied insulation

Criteria

1. ***Exterior walls including band area***
2. ***Floor system over crawlspace or basement***

Clarifications

Spray foam insulation must qualify as a full air barrier product in order to achieve credit.

Confirmation

- Project team will submit product specifications showing air barrier qualifications.
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at pre-drywall inspection.

BE 3.16 Walls

Criteria

1. ***Seal and insulate crawlspace walls:***
   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 described in **DU 1.8**. If installed, crawlspace must be closed.

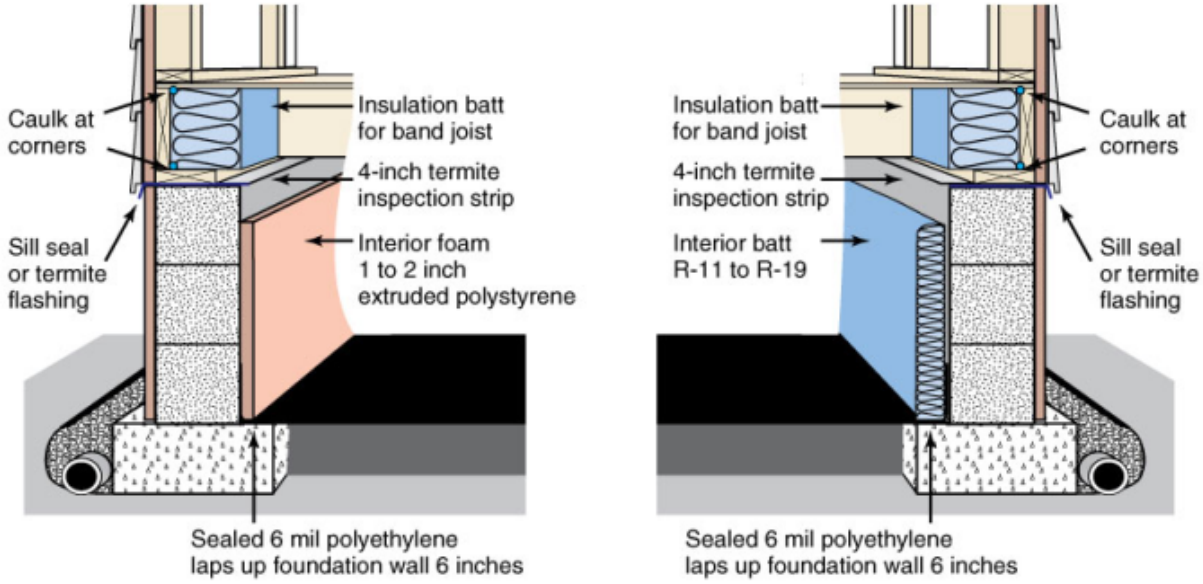


Figure 57: Enclosed crawlspace with insulation along walls

2. Insulate unfinished basement walls instead of ceiling

Insulate basement walls instead of floor-joist cavities over basement. Basement walls more than half below grade must be either R-13 cavity insulation or R-5 continuous insulation in Climate Zones 2 and 3 or R-10 continuous in Climate Zone 4. Use code-approved materials. Above-grade basement and foundation walls must be insulated to meet minimum wood or mass wall requirements (e.g., R-13 cavity insulation for wood frame wall).

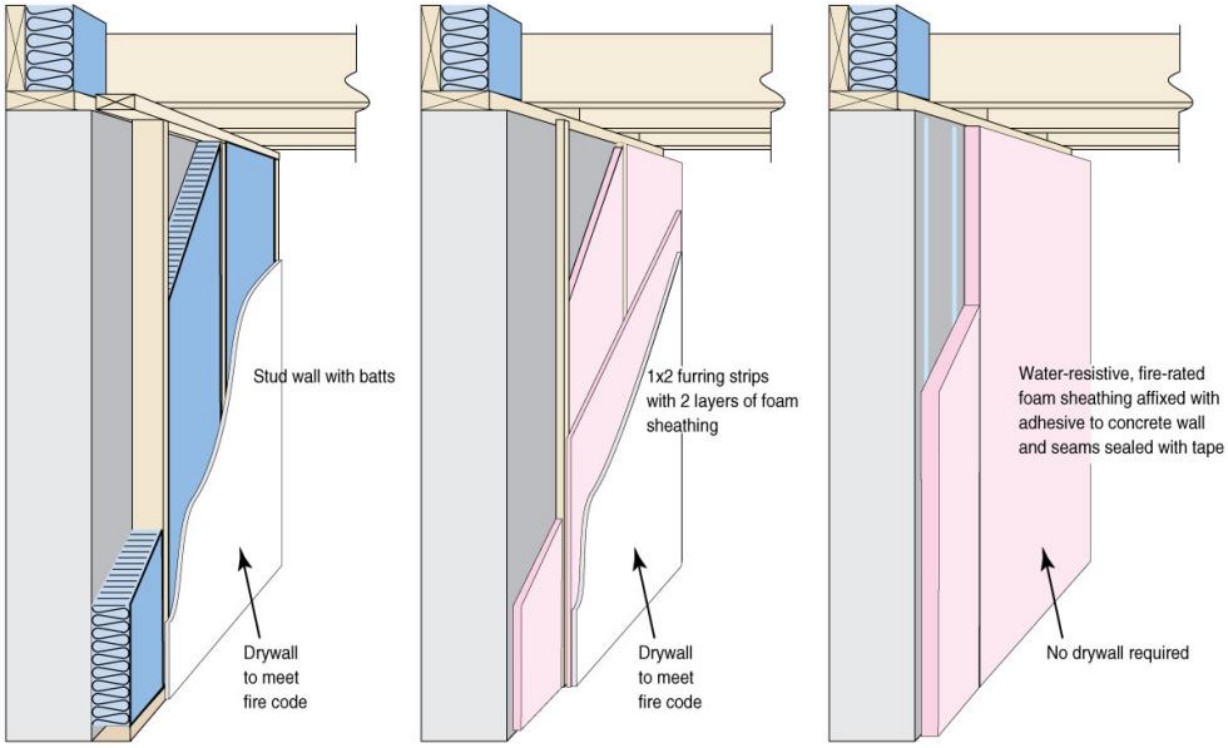


Figure 58: Basement wall insulation

3. Insulate basement walls with continuous insulation

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.

4. Insulate exterior walls and band joist ≥R-19

Install wall stud cavity insulation to R-19 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.

Insulate all band joist areas between conditioned floors using R-19 insulation. Insulation must be installed using manufacturer recommendation for permanent alignment with band joist.

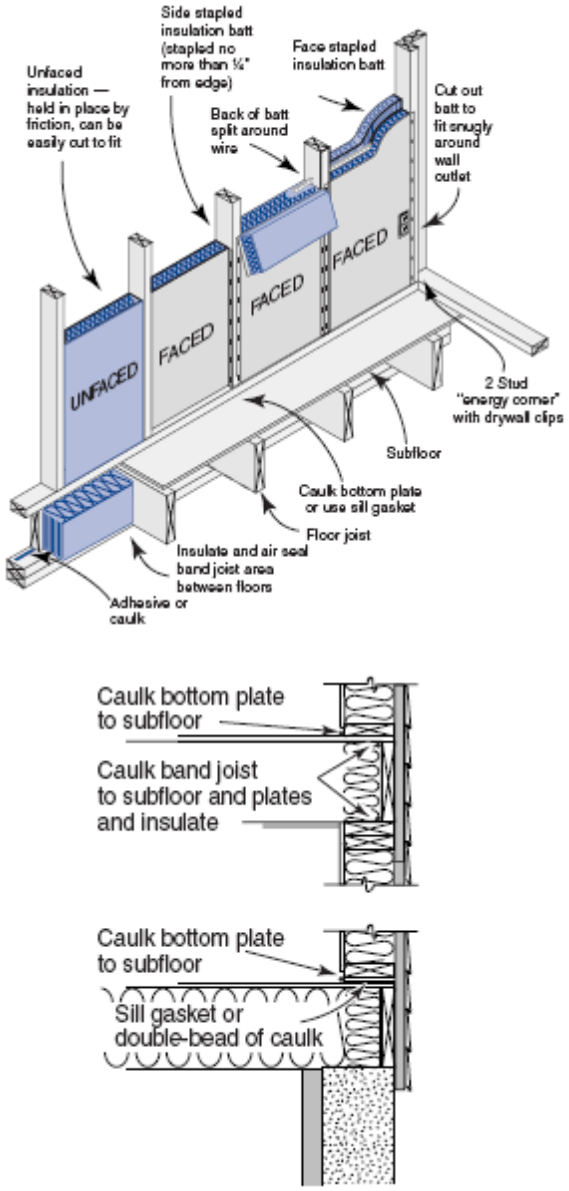


Figure 59: Exterior Wall and Band Joist Insulation

5. Insulate exterior walls and band joist ≥R-20 or ≥R-13 cavity plus R-5 insulated sheathing

Clarifications

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

Example

To ensure continuous insulation, offset double stud walls, align double stud walls with continuous insulation between adjacent stud faces, or build single-stud walls with 2x2 or 2x3 cross-framing.

Typical products for providing continuous insulation of R-13 or greater include insulated concrete forms and structurally insulated panels (SIPs). SIP walls using occasional (e.g., ≥4' on center) studs for locking mechanisms between SIP panels qualify.

Additional Resources

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

For more details on 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 with criteria at pre-drywall inspection.

BE 3.17 Continuous exterior insulation

Criteria

A. ≥R-3 (100%)

Install R-3 or greater continuous insulation 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.

B. ≥R-5 (100%)

Install R-5 or greater continuous insulation 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.

These points are attainable only for wood-framed construction. Steel studs will require a thermal break of R-7.5 per ASHRAE 90.1 standards.

Confirmation

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

BE 3.18 Ceilings

Criteria

1. Flat Vented: Climate Zone 4 ≥R-49

Insulate flat ceilings with unconditioned attic space above using R-49 or greater in Climate Zone 4. A maximum of 5% of ceiling area up to 500 sq ft may be R-30 or greater to accommodate elevated attic flooring for storage and mechanical equipment.

2. Continuous Roof Deck: Climate Zone 4 ≥R-30

For roofs with continuous insulation located entirely above deck, insulate to ≥ R-30

3. Sloped: Climate Zone4 ≥R-49

Insulate sloped ceilings using R-49 or greater Climate Zone 4.

Clarifications

Insulated rooflines and vaulted cathedral ceilings are not considered sloped ceilings; sloped ceilings are defined to have unconditioned attic space above.

Please see the following criteria related to insulated rooflines and vaulted cathedral ceilings: "Insulate roofline of attic to create unvented attic ≥R-19".

Confirmation

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

BE 3.19 Attic kneewall insulated ≥R-22

Criteria

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.

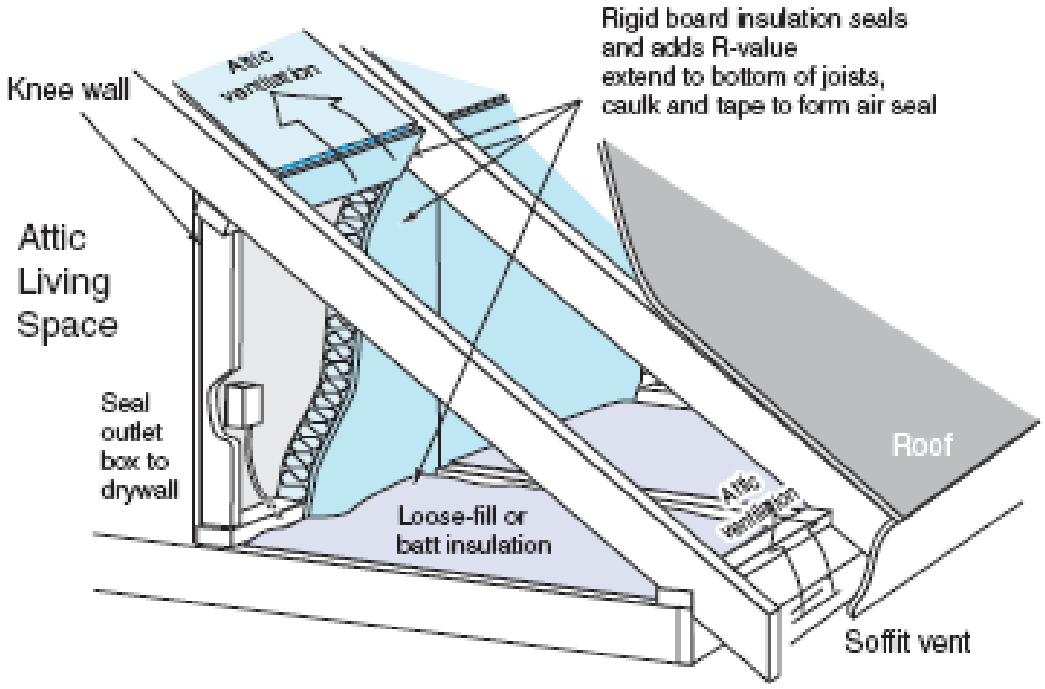


Figure 60: Attic kneewall insulation

Confirmation

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

BE 3.20 Insulate roofline to ≥R-30

Criteria

Insulate roofline with spray foam

Insulate roofline of attic using foam insulation ≥R-30 to create an unvented attic.

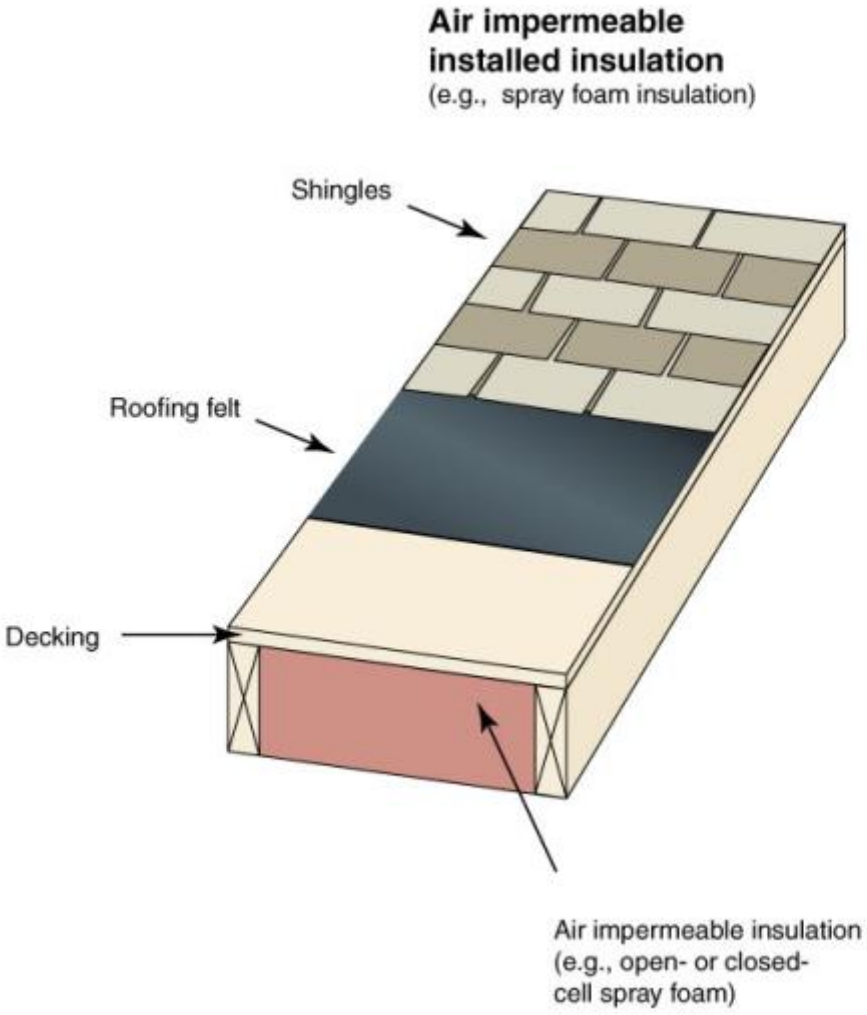


Figure 61: Insulated Roofline

Clarifications

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

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

BE 4.0 Door U-factor and SHGC

Criteria

1. ***U-factor: Climate Zone4 ≤0.35***

All doors in Climate Zone 4 must have a U-factor less than or equal to 0.35.

2. ***SHGC ≤0.30***

All doors in Climate Zones 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.30.

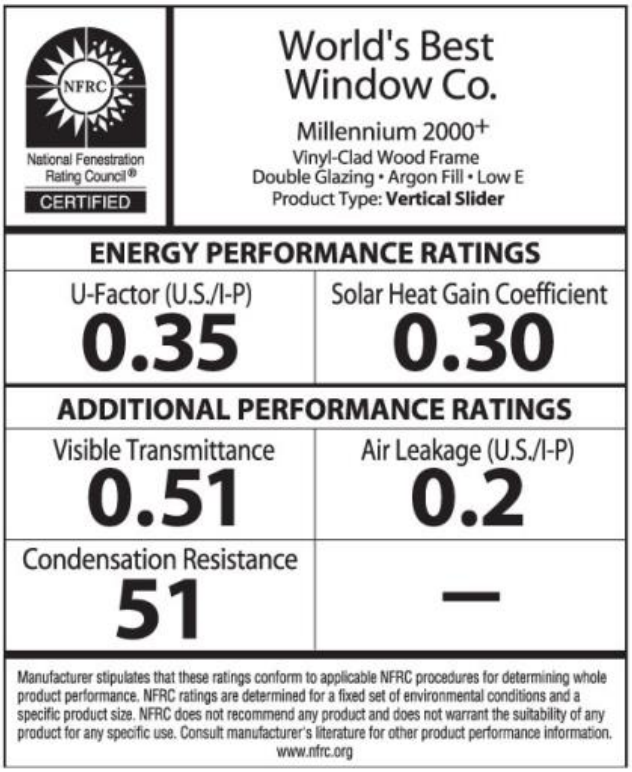


Figure 62: NFRC window label

Clarifications

The U-factor for doors applies to the whole door assembly not just the glass portion.

Exemptions

If a building meets the requirements for BE 4.12 "certified passive solar design", windows, skylights and doors need only meet mandatory U-factor (0.48 in Climate Zone 4) and SHGC (0.50 in Climate Zones 2 and 3) requirements in the 2009 IECC. The mandatory requirements are different from the prescriptive requirements.

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 4 ≤0.35

All windows in Climate Zone 4 must have a U-factor less than or equal to 0.35.

2. SHGC ≤0.30

All windows in Climate Zones 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.30.

Clarifications

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

Exemptions

If a building meets the requirements for BE 4.12 "certified passive solar design", windows, skylights and doors need only meet mandatory U-factor (0.48 in Climate Zone 4) and SHGC (0.50 in Climate Zone 2 and 3) requirements in the 2009 IECC. The mandatory requirements are different from the prescriptive requirements.

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 4 ≤0.60

All skylights in Climate Zone 4 must have a U-factor less than or equal to 0.60.

2. SHGC ≤0.30

All windows in Climate Zones 4 must have a Solar Heat Gain Coefficient (SHGC) less than or equal to 0.30.

Clarifications

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

Exemptions

If a building meets the requirements for BE 4.12 "certified passive solar design", windows, skylights and doors need only meet mandatory U-factor (0.48 in Climate Zone 4) and SHGC (0.50 in Climate Zone 2 and 3) requirements in the 2009 IECC. The mandatory requirements are different from the prescriptive requirements.

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 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 4.4 Door U-factor

Criteria

1. ***Opaque door: U-factor ≤0.21***

All opaque doors (doors with no glass) in climate zone 2, 3, and 4 must have a U-factor of 0.21 or less.

2. ***Door with ≤ half-glass: U-factor ≤0.27***

All glass doors composed of less than half-glass or half glass must have a U-factor of 0.27 or less.

3. ***Door with > half-glass: U-factor ≤0.32***

All glass doors composed of more than half-glass must have a U-factor of 0.32 or less.

Clarifications

The U-factor for doors applies to the whole door assembly not just the glass portion. Not applicable if the door is leading to a conditioned space (i.e. conditioned corridor).

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 4.5 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

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.

The U-factor for doors applies to the whole widow assembly not just the glass portion.

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 4.6 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 ≤0.27***

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

Clarifications

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.

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 4.7 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 Zone2/3/4 ≤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

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

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 4.8 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 ≤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.

BE 4.9 West and East facing glazing

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 unit 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.

BE 4.10 1.5’ overhangs over 80% of south-facing window area

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.

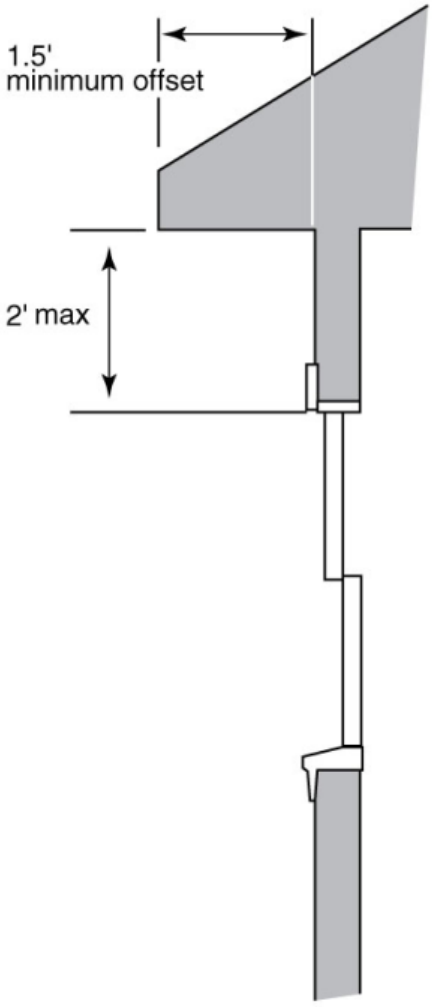


Figure 63: Window overhang

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.

BE 4.11 Solar shade screens (all east and west facing windows)

Criteria

Install solar shade screens on all east and west facing windows with a shading coefficient of 0.7 or greater. Shade screen must be installed on exterior of window glazing.

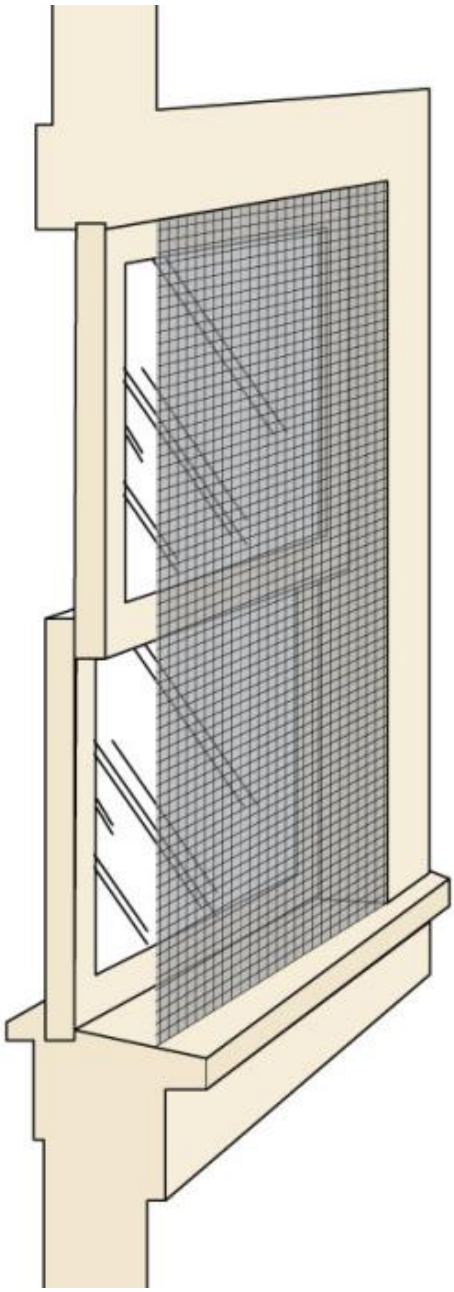


Figure 64: Solar shade screen

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

BE 4.12 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 ≥ 20 Btu/ft 3 x °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.

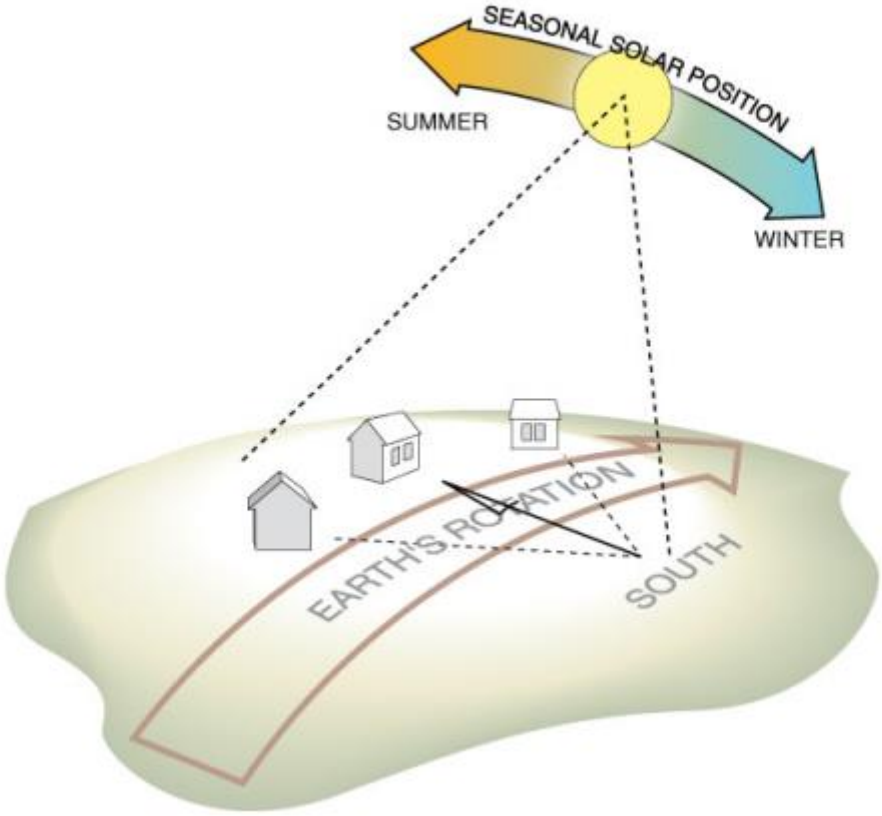


Figure 65: Seasonal solar position

Confirmation

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

BE 4.13 Window area is ≤15% of conditioned floor area (all units)

Criteria

To improve energy efficiency and comfort by reducing the solar heat gain into individual units. Keeping the window to conditioned floor area ratio at a minimum will improve the results of the unit level energy models.

Clarification

Area of glazing equals 100 square feet and conditioned floor area of unit is equal to 850 square feet.

$$\frac{\text{100sf of glazing}}{\text{850sf of floor area}} = .118 \text{ ratio or } 11.8\%$$

Confirmation

- The project team must submit unit level calculations demonstrating compliance with criteria.
- The EarthCraft Technical Advisor will visually verify window to CFA ratios during site inspections.

Roof

BE 5.0 Install green roof system

Criteria

Install a green roof system on a percentage of the total roof area across the development in order to manage storm water runoff, provide additional insulation value, and combat the heat island effect.

A. ≥20% of roof area is covered by a green roof system.

B. ≥40% of roof area is covered by a green roof system.

C. ≥60% of roof area is covered by a green roof system.

Example

A roof partially or completely covered by vegetation on top of a growing medium and a waterproof membrane.

Confirmation

- The project team must provide design details demonstrating compliance with criteria at a specified level (20%/40%/60%).
- The EarthCraft Technical Advisor will visually confirm compliance with criteria at final inspection.

Energy Efficient Systems

Constructing an energy-efficient development provides a variety of benefits to both 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 high performance buildings.

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 the project. 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

OR

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

2. ***Based on worst case unit orientation***

Load calculation must be based on worst case orientation for each unit type as constructed.

3. ***Use 2009 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 2009 ASHRAE Handbook of Fundamentals, Chapter 14.

- 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 project team selected infiltration goal.***

Select project team infiltration goal or software equivalent for unit infiltration.

6. ***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.

7. ***Base mechanical ventilation on ASHRAE 62.2 or BSC-01 standard***

Load calculation must be based on ventilation system designed and installed to meet ASHRAE 62.2-2007 or BSC - 01. This includes the ventilation system type, location, design rate, and frequency and duration of each ventilation cycle.

8. ***Cooling equipment and/or single-stage heat pump between 95-125% for heat pump***

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 should be based on the largest capacity of the unit.

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

Base infiltration may use more stringent criteria such as "tight" for whole house infiltration.

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 x 1.15 = 41,400 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 ton 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 Advisor 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

2009 ASHRAE Handbook of Fundamentals Climate Design Information (abridged)

Meaning of acronyms: DB: Dry bulb t mperature, °F MCWB: Mean coincident wet bulb temperature, °F WB: Wet bulb temperature, °F

Station	Elev	Heating DB	Cooling DB/MCWB	
		99%	1%	
			DB / MCWB	
United States of America				
Alabama				
AUBURN-OPELIKA APT	774	27.7	90.7	73.7
BIRMINGHAM MUNICIPAL AP	630	24.0	92.6	74.9
CAIRNS AAF/OZARK	299	30.3	93.4	76.1
DOTHAN MUNICIPAL	322	31.1	93.2	75.7
GADSEN MUNI (AWOS)	568	22.1	91.2	74.5
HUNTSVILLE INTL/JONES FIELD	643	21.6	92.2	74.7
MAXWELL AFB/MONTGOM	174	31.5	95.2	76.6
MOBILE REGIONAL AP	220	30.7	91.8	76.4
MONTGOMERY DANNELLY FIELD	203	27.3	94.0	76.1
MUSCLE SHOALS REGIONAL AP	561	22.1	93.1	75.2
TUSCALOOSA MUNICIPAL AP	187	25.0	93.4	76.3
Georgia				
ALBANY DOUGHERTY COUNTY AP	194	29.7	94.5	76.1
ATHENS BEN EPPS AP	801	26.1	92.7	74.6
ATLANTA (NEXRAD)	971	23.2	90.7	73.8
ATLANTA HARTSFIELD INTL AI	1027	25.8	91.5	74.0
AUGUSTA BUSH FIELD	148	25.8	94.7	76.0
AUGUSTA\DANIEL FLD	420	29.9	93.1	73.7
COLUMBUS METROPOLITAN ARPT	394	28.9	94.1	74.8
DEKALB PEACHTREE	1027	26.8	91.2	73.5
DOBBINS AFB/MARIETT	1083	25.0	91.0	73.8
FORT BENNING	289	26.6	94.3	75.7
FULTON CO ARPT BROW	863	24.9	91.4	74.4
GAINESVILLE\LEE GIL	1276	27.1	90.3	73.7
HUNTER AAF	43	31.8	93.3	76.9
MACON MIDDLE GA REGIONAL AP	361	27.4	94.3	75.5
MOODY AFB/VALDOSTA	233	33.7	93.7	76.2
ROME R B RUSSELL AP	643	22.1	93.3	74.3
SAVANNAH INTL AP	52	30.6	93.3	76.9
VALDOSTA WB AIRPORT	197	30.9	93.4	76.6
WARNER ROBINS AFB	302	28.2	94.9	76.0
North Carolina				
ASHEVILLE REGIONAL ARPT	2169	18.6	85.8	70.9
CHARLOTTE DOUGLAS INTL ARPT	768	24.6	91.7	74.2
FAYETTEVILLE RGNL G	194	25.6	93.1	75.6
FORT BRAGG/SIMMONS	305	26.0	94.0	75.7
GREENSBORO PIEDMONT TRIAD INT	886	21.7	89.9	73.9
HICKORY REGIONAL AP	1188	23.3	90.1	72.9
JACKSONVILLE (AWOS)	95	24.7	91.3	75.7
NEW RIVER MCAF	26	26.8	91.1	77.5

Station	Elev	Heating DB	Cooling DB/MCWB	
		99%	1%	
			DB / MCWB	
United States of America				
NEW RIVER MCAF	26	26.8	91.1	77.5
PITT GREENVILLE ARP	26	24.9	93.1	75.5
POPE AFB	217	25.2	94.3	75.7
RALEIGH DURHAM INTERNATIONAL	436	23.1	91.7	75.6
RICHMOND INTERNATIONAL AP	164	20.8	92.3	75.4
SEYMOUR-JOHNSON AFB	108	26.2	93.5	76.1
WILMINGTON INTERNATIONAL ARPT	39	27.6	91.0	77.5
WINSTON-SALEM REYNOLDS AP	971	22.8	90.3	73.9
South Carolina				
CHARLESTON INTL ARPT	49	30.4	92.1	77.6
COLUMBIA METRO ARPT	226	25.9	94.5	75.1
FLORENCE REGIONAL AP	151	26.9	93.4	76.2
FOLLY ISLAND	16	34.9	86.2	N/A
GREER GREENV'L-SPARTANBRG AP	971	24.7	91.4	73.9
SHAW AFB/SUMTER	243	27.5	92.9	75.1
Tennessee				
BRISTOL TRI CITY AIRPORT	1526	16.9	87.5	71.7
CHATTANOOGA LOVELL FIELD AI	689	22.3	92.1	74.6
JACKSON MCKELLAR-SIPES REGL A	423	18.7	92.6	76.6
KNOXVILLE MCGHEE TYSON AP	981	20.2	90.2	73.9
MEMPHIS INTERNATIONAL AP	331		93.9	76.9
MILLINGTON MUNI ARP	322	19.6	95.0	76.5
NASHVILLE INTERNATIONAL AI	604	18.2	92.1	74.8
Virginia				
DANVILLE FAA AP	591	22.1	91.0	74.3
DINWIDDIE CO	197	19.2	94.7	76.7
FORT BELVOIR/DAVISO	89	17.9	93.2	75.2
LANGLEY AFB/HAMPTON	10	24.8	90.5	76.5
LEESBURG/GODFREY	390	17.9	91.8	75.6
LYNCHBURG REGIONAL ARPT	938	18.9	89.7	73.2
MANASSAS MUNI(AWOS)	194	16.3	90.5	73.6
NEWPORT NEWS	52	22.7	91.6	76.6
NORFOLK INTERNATIONAL AP	30	25.6	91.3	76.0
NORFOLK NAS	16	26.8	91.2	76.7
OCEANA NAS	23	25.3	90.4	76.4
QUANTICO MCAS	13	19.7	90.4	75.9
ROANOKE REGIONAL AP	1175	19.0	89.8	72.4
STAUNTON/SHENANDOAH	1201	16.8	91.0	73.9
VIRGINIA TECH ARPT	2133	15.7	86.1	70.6
WASHINGTON DC DULLES INT'L AR	325	15.7	90.8	74.3
WASHINGTON DC REAGAN AP	66	20.3	91.7	75.2

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

9. Provide OEM data for each unique system type

10. Internal loads that reflect design and occupancy ≤2400 Bth/h

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 If programmable thermostat installed for heat pump, include adaptive recovery technology

Criteria

If a heat pump is installed and a programmable thermostat is used, the thermostat must be equipped with an adaptive recovery technology. Adaptive recovery prevents the system from relying on strip heat to quickly raise temperatures also resulting in increased energy use.

Confirmation
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection. If necessary, the mechanical contractor must confirm in writing that the adaptive recovery system has been activated during installation.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with criteria at final inspection.

ES 1.2 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
www.ahridirectory.org

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

ES 1.3 Non-CFC and non-HCFC refrigerant

Criteria
Install cooling equipment that contains non-CFC or non-HCFC refrigerant (e.g., R410a).

Exemptions
Projects not using any refrigerants automatically meet intent provided they demonstrate alternative cooling strategies appropriate for a mixed-humid climate.

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

ES 1.4 No electric resistance heat as primary heat source or reheat

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 or used in a reheat design.

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

ES 1.5 Heat pump efficiency ≥ 8.0 HSPF or equivalent COP

Criteria
Heat pumps must have an efficiency of at least 8.0 HSPF or greater.

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

ES 1.6 Furnace efficiency ≥ 90 AFUE

Criteria

Furnaces must be rated at least 90 AFUE.

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

ES 1.7 Cooling equipment ≥14 SEER or 11 EER

Criteria

Cooling equipment must surpass 14 SEER or 11 EER ratings.

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

ES 1.8 Heating equipment efficiency

Criteria

A. A. ENERGY STAR qualified furnace(s) ≥90% AFUE and within 40% of load calculation

All heating equipment must be ENERGY STAR qualified and 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.

B. ENERGY STAR qualified 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 ENERGY STAR qualified 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.

Clarifications

An 8.2 HSPF for heat pumps in Climate Zone 4 qualifies when the heat pump is ENERGY STAR qualified with dual-fuel back-up.

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

ES 1.9 Verification of proper refrigerant charge with subcooling deviation ±3°F or superheat deviation ±5°F

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.

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.

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

ES 1.10 ENERGY STAR qualified cooling equipment ≥14.5 SEER

Criteria

Install high efficiency ENERGY STAR qualified cooling equipment (SEER 14.5+). All cooling equipment must have a minimum Seasonal Energy Efficiency Ratio (SEER) of 14.5 or a minimum of 12 Energy Efficiency Ratio (EER) showing the SEER rating of each unit.

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 EarthCraft Technical Advisor will visually confirm compliance with criteria at final inspection.

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 Ground-source heat pump(s) ≥17 EER

Criteria
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).

Additional Resources
Air Conditioning, Heating and Refrigeration Institute (AHRI) at http://www.ahrinet.org.

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 1.13 ENERGY STAR qualified cooling equipment ≥16 SEER

Criteria
Install high efficiency ENERGY STAR qualified 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.

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

ES 1.14 Heat pump efficiency ≥ 9.0 HSPF

Criteria

Installed heat pumps must have an efficiency rating of at least 9.0 HSPF.

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

ES 1.15 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 should 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 with criteria at final inspection.

ES 1.16 Condenser units are spaced 2 feet apart

Criteria

Condenser units must be spaced at least 2 feet apart to reduce restriction of airflow across the condensing coil.

ES 1.17 Variable Refrigerant/Mini-Split system utilized for primary heating and cooling

Criteria

Primary heating and cooling provided to the space using Variable Refrigerant/Mini-Split system.

Confirmation
- The EarthCraft Technical Advisor 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.

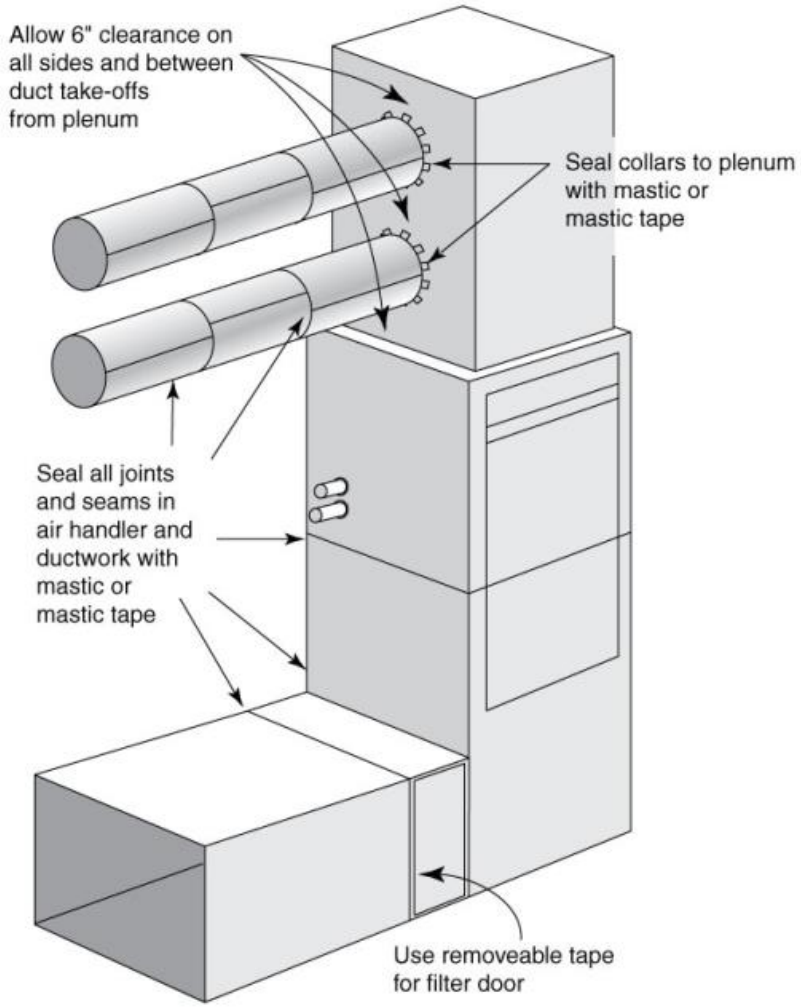


Figure 66: Common mastic locations

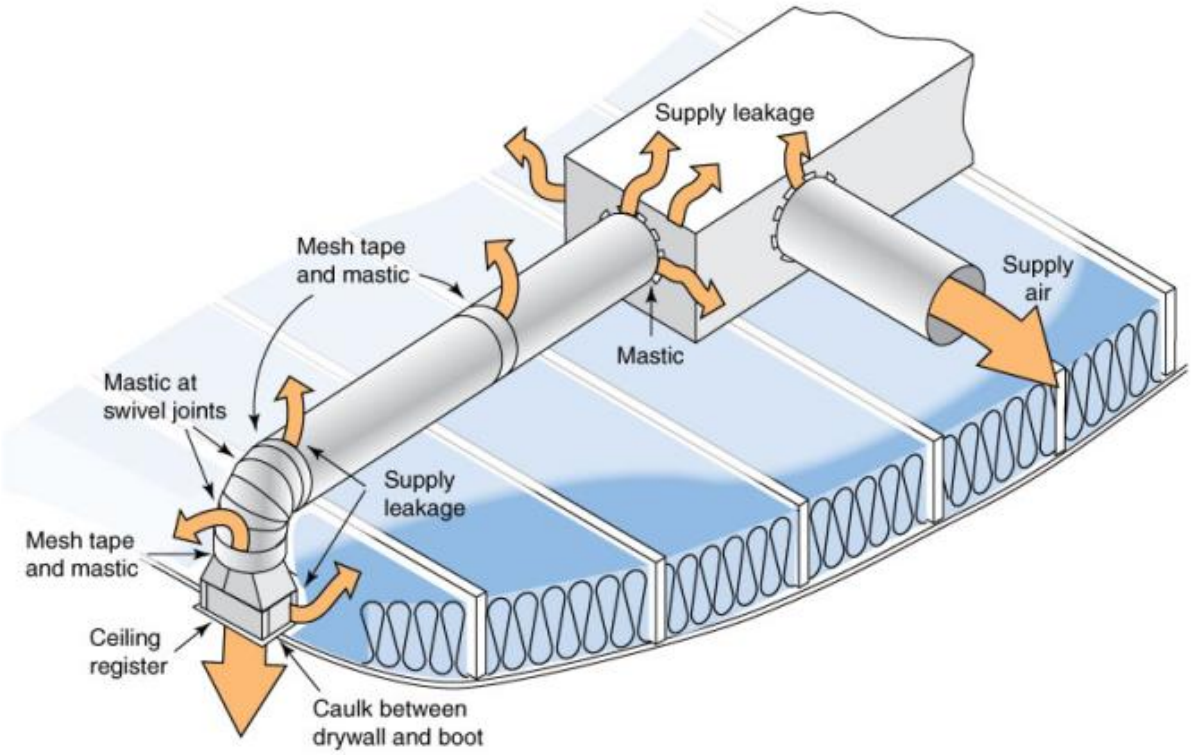


Figure 67: Common mastic locations (1)

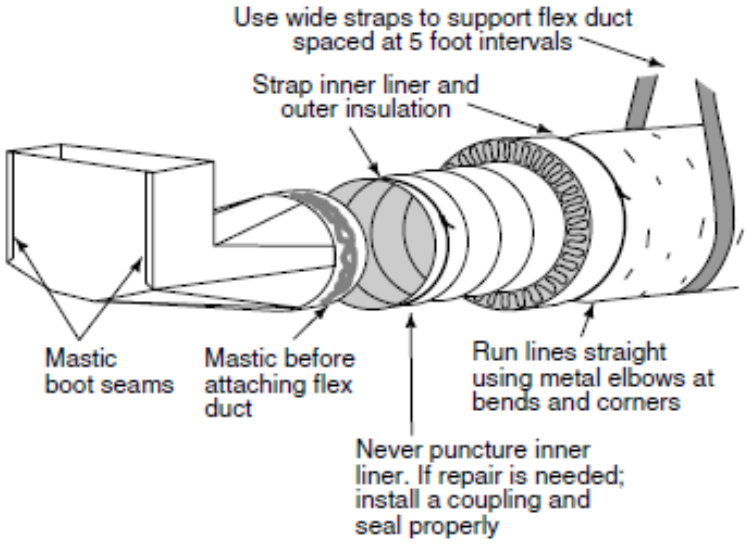


Figure 68: Common mastic locations (2)

Confirmation

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

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.

ES 2.2 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). An open return may be acceptable if a locked, full louvered door is provided. Additional attention will be placed on utilizing the mechanical closet as a plenum.

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 2.3 Duct insulation

Criteria

1. ***R-4: Conditioned spaces***

All ducts located in conditioned space and interstitial spaces (between floors) must be insulated to R-4.

2. ***R-8: Unconditioned attics and exterior***

Insulate all ducts and all duct connections in unconditioned attics and exterior locations using R-8 insulation or greater.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. Duct insulation within conditioned space is primarily for condensation prevention.

Confirmation

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

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 stairwell and the unit.

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 Locate air handler within conditioned space

Criteria
Locate all air handlers within conditioned space.

Clarifications
Any atmospherically-vented furnace (e.g., 80 AFUE furnaces) are required to be isolated from conditioned space (e.g., located in combustion closets) and thus are not considered to be within conditioned space.

Example
A sealed combustion, 90% furnace or heat pump located within conditioned space would satisfy this requirement.

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

ES 2.6 Indoor coil protected

Criteria
Protect and cover indoor coil until finished floor is installed to reduce particulate matter and pollutants from entering the HVAC system.

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

ES 2.7 Install ducts per ACCA Manual D duct design

Criteria
Design and install ductwork in accordance with ACCA Manual D guidelines latest edition or equivalent ASHRAE Handbook of Fundamentals method. 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.

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 inspection.

ES 2.8 Minimize pressure imbalance within units ≤3 pa

Criteria

1. ***Reduce pressure imbalance between bedrooms and area of central return (living room) through various methods including appropriate duct sizing, door undercuts, dedicated return ducts, jumper ducts, transfer grills or other.***

2. ***Measured Pressure imbalance must achieve ≤3 pa between bedrooms and central return.***

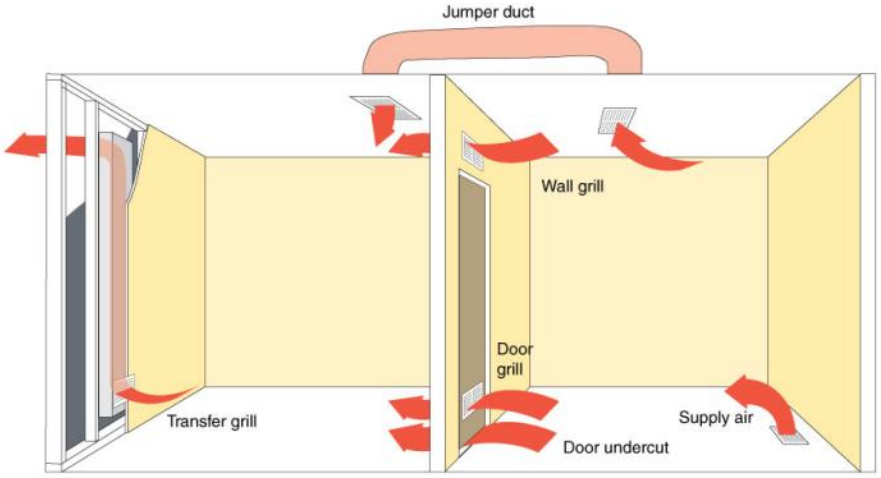


Figure 69**: Return air pathways**

Confirmation

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

ES 2.9 Install rigid duct work or pull all flex duct tight 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, and located above ceiling insulation to prevent condensation.

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

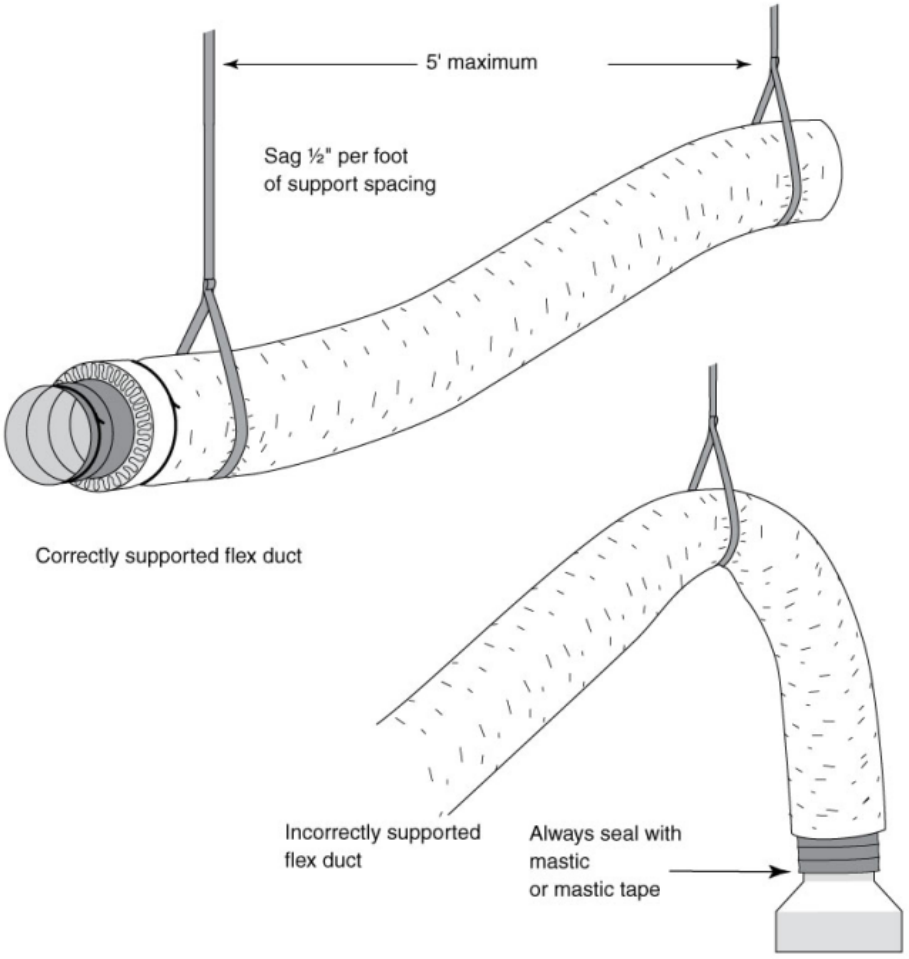
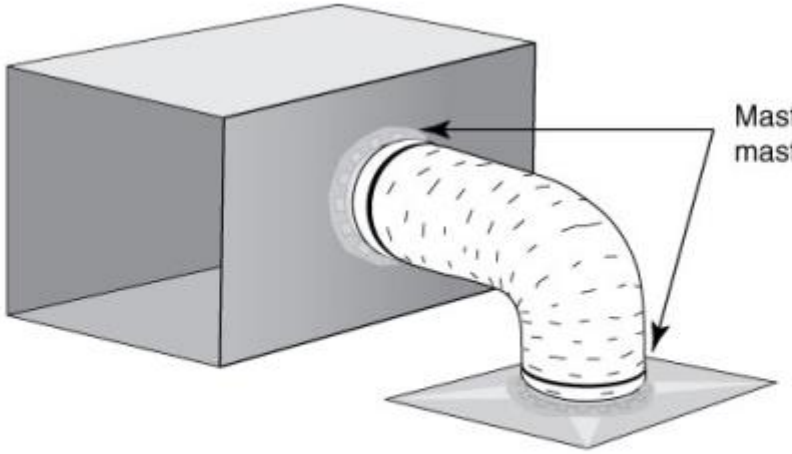
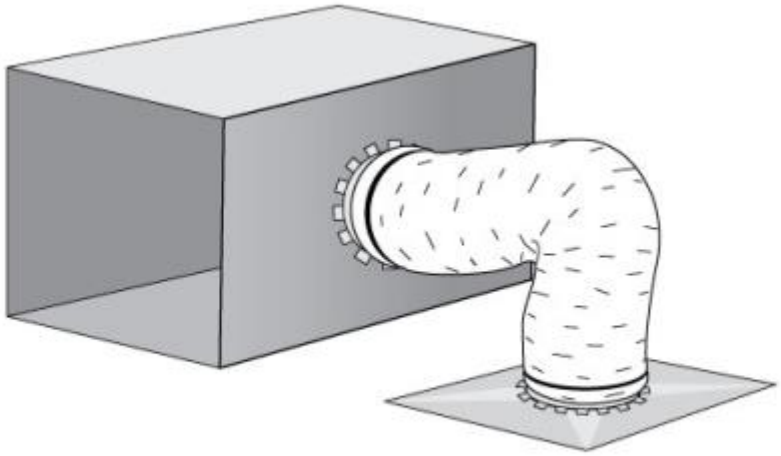


Figure 70: Correct (top) and incorrect (bottom) ductwork installation



Correct: flex duct installed with enough material, to create smooth turns with proper angles



Incorrect: flex duct installed with extra material, creating bunched turns with pinched angles

Figure 71: Correct (top) and incorrect (bottom) ductwork installation

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

ES 2.10 Measure and balance airflow for each duct run

Criteria

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.

Clarifications

Ducts shall not include coiled or looped ductwork except to the extent needed for acoustical control.

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.

Confirmation

- The builder must submit documentation demonstrating compliance of criteria to the EarthCraft Technical Advisor at the final inspection.

ES 2.11 Verify supply and return duct static pressure

Criteria

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

Clarifications

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

- 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 diagnostically test compliance of criteria at the final inspection.

ES 2.12 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 2.13 Locate entire duct system within conditioned space

Criteria

Locate entire supply and return ducts within conditioned space.

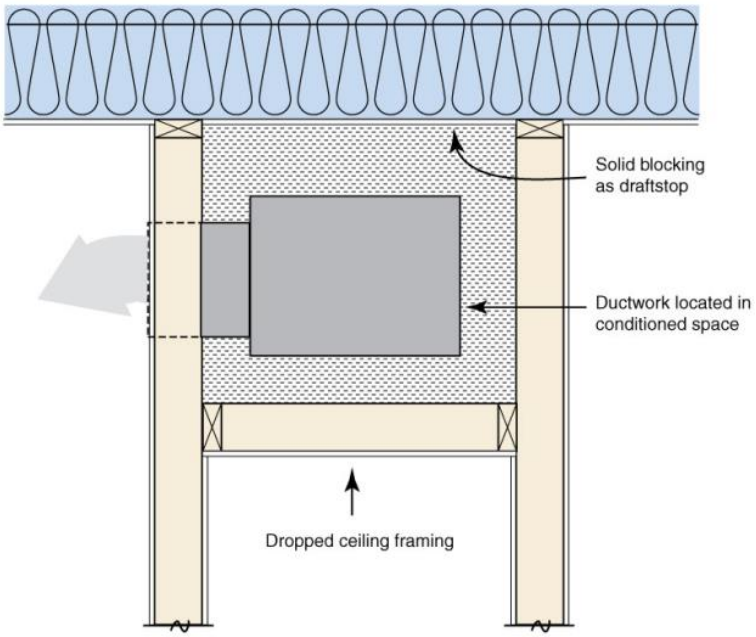


Figure 72: Ducts in conditioned space

Confirmation

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

ES 2.14 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.

4. Install rigid circular duct as supply plenum from air handler

To improve ductwork efficiency by reducing the duct leakage commonly found at the plenum board connection to the air handler. Seal all duct connections with mastic.

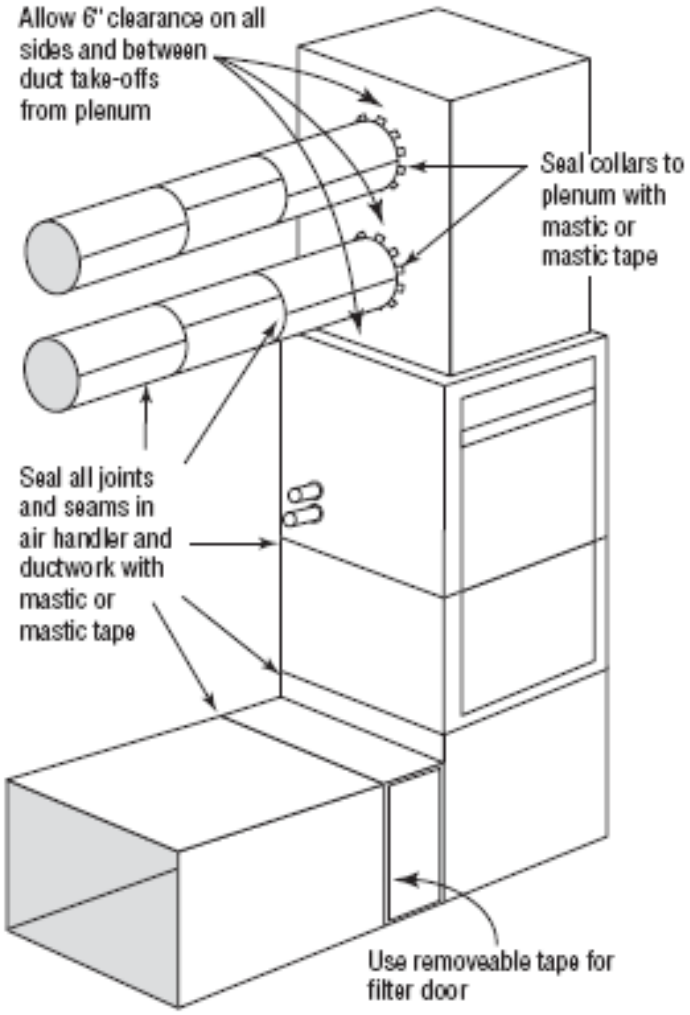


Figure 73: Duct installation at plenum

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

ES 2.15 Duct insulation in unconditioned spaces ≥R-10

Criteria

Insulate all ducts outside of conditioned spaces (e.g., in unconditioned attics, vented crawlspaces, and exterior locations) to R-10 insulation or greater.

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

ES 2.16 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.

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.

ES 2.17 Design and construct accessible mechanical closets

Criteria
Design and construct mechanical closets that are easily accessible for routine maintenance, repairs, and filter replacement.

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

Duct Leakage Test Results

ES 3.0 Test duct leakage based on conditioned floor area (CFA)

Criteria

1. ***Leakage to outside ≤5%***

Duct blaster test result for leakage to outside is equal to or less than 5% of floor area served.

2. ***Total leakage ≤8%***

Duct blaster test result for total leakage is equal to or less than 8% 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.

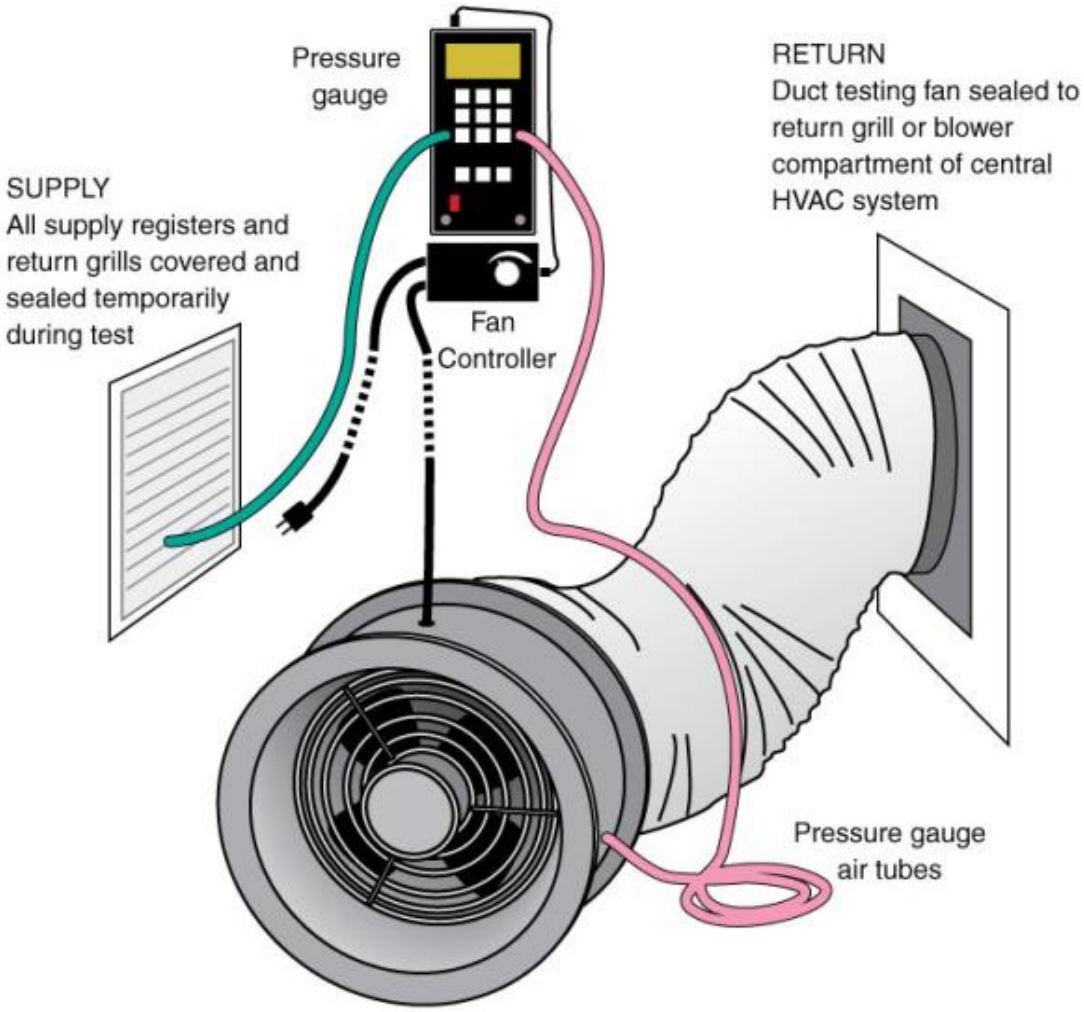


Figure 74: Duct leakage tester

Calculate duct leakage using the following formula:

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

Where 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 unit or building.

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.

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

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%.

$$12\% \text{ leakage} = \frac{240 \text{ cfm}_{25}}{2{,}000 \text{ sq ft}}$$

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

ES 3.1 Test duct leakage based on conditioned floor area (CFA)

Criteria

1. ***Leakage to outside ≤3%***

Duct leakage test result for leakage to outside for each HVAC system is equal to or less than 3% of floor area served.

2. ***Total leakage ≤5%***

Duct leakage test result for total leakage for each HVAC system is equal to or less than 5% 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 unit or building.

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 in units with 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 Install exhaust fans in all bathrooms and duct to outside

Criteria
Vent all bathroom exhaust fans to outdoors.

Clarifications
Any room with at least two of the following fixtures is considered a bathroom: sink, toilet, shower, tub, or urinal.

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

ES 4.1 Gas kitchen range or cooktop vented to exterior with ≥100 cfm

Criteria

For each gas range or 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 62.2-2007 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 20% 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 with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance with criteria.

OR

Third-party testing

- The EarthCraft Technical Advisor will diagnostically test for compliance with criteria at the final inspection.

ES 4.2 Outside air ventilation strategy complies with ASHRAE 62.2-2007 or BSC-01 and must be conditioned prior to distribution

Criteria

Install outside air intake with ventilation cfm, mechanical damper, and controls meeting ASHRAE 62.2-2007 or BSC-01 mechanical ventilation requirements and must be conditioned prior to distribution.

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

Intermittent ventilation with timer, manual flow damper, and electric shutoff damper

Install outdoor air intake duct with a ventilation timer, manual flow damper and electric shutoff damper to the return side of each air handler to bring in outside air for ventilation.

Calculate flow rate according to ASHRAE Standard 62.2-2007 for intermittent mechanical ventilation:

$$\text{Fan Flow} = \frac{0.01 * \text{Floor Area} + 7.5 * (\#\ \text{Bedrooms} + 1)}{\%\ \text{on Time}}$$

Designed and installed to operate at least once per day and at least 10% of the time (one hour out of every twelve).

The inlet must meet manufacturers' requirements for return air temperature (e.g., most manufacturers recommend a minimum of 60 °F airflow across furnace heat exchangers).

Intermittent ventilation system that utilize the HVAC air handler must include a controller to regulate the ventilation run time by accounting for hours when HVAC systems are not heating or cooling.

Continuous ventilation

Calculate flow rate according to ASHRAE Standard 62.2-2007 for continuous mechanical ventilation:

Fan Flow = 0.01 * Floor Area + 7.5 * (# Bedrooms + 1)

Design continuous ventilation system to operate during all occupiable hours.

Continuous ventilation system that utilize the HVAC air handler must install a fan speed type that shall be Electronically Commutated Motor/ Integrally Controlled Motor (ECM/ICM), variable speed, and run at a reduced speed during ventilation.

BSC-01 criteria can be found online at: http://www.buildingscience.com/documents/special/ventilation-new-low-rise-residential-buildings

Clarifications

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

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 4.3 When installed, fresh air intakes must achieve the following standards:

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. ***≥2 above grade***

Locate air intakes 2 feet above finished grade.

3. ***When run to the soffit, the duct must be extended and affixed through soffit vent.***

If running fresh air through the soffit, it must extend and be affixed all the way through the soffit vent and may not terminate and rest on top of the soffit.

4. ***Fresh air duct may not be run to the roof***

Do not run fresh air to the roof of the structure. Exception: Central fresh air systems.

5. Fresh air shutoff may not be controlled by humidistat

If using a fresh air shutoff, it cannot be controlled by the humidistat.

6. Install rigid duct with insulation

When ducting the fresh air into a unit, use rigid duct work with insulation that meets at least code minimum.

7. All intakes must be ducted to the exterior of the building

Locate air intakes for all building systems outside of the building shell.

Clarifications

Air intakes include intakes for closed-system combustion equipment, 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 by 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 over time, therefore EarthCraft recommends, but does not require, that builders locate inlets to facilitate access and regular service by the maintenance staff.

Confirmation

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

ES 4.4 Seal seams of all intake and exhaust ducts with mastic

Criteria

Mastic paste must be used on the sealing of all ducts. Coat duct seams and connections with layer of mastic paste covering seams by 1.5” on both sides and as thick as a nickel.

Confirmation

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

ES 4.5 Duct clothes dryers to outside

Criteria

All clothes dryers must be ducted to the outside.

Clarifications

For electric condensing dryers, plumb condensate to a drain according to manufacturer instructions.

Confirmation

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

ES 4.7 Back-draft dampers for kitchen, bathroom and dryer exhausts

Criteria

Install back-draft dampers for all exhaust fans sharing a common exhaust.

Clarifications

Common exhausts may not be shared by fans in separate dwelling units (e.g., townhomes).

Confirmation

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

ES 4.8 If installed, ceiling fans must be ENERGY STAR qualified

Criteria

If installed, all ceiling fans must be ENERGY STAR qualified. One per bedroom and one in the living room.

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 with criteria to the EarthCraft Technical Advisor at the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the builder for compliance with criteria and will visually confirm compliance with criteria at final inspection.

ES 4.9 ENERGY STAR bath fans with properly sized ductwork and measured airflow ≥50 cfm

Criteria

All bathroom ventilation fans must be ENERGY STAR qualified with properly sized ductwork and measured airflow ≥50 cfm.

To ensure the installed fan exhausts the correct amount of cfm, bath fans must either be rated at a higher airflow than 50 cfm (minimum 70 cfm rating) or have an installed measured airflow verified by a third-party ≥50cfm.

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

Measured airflow fan (testing not required)

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

OR

Third party-testing

- The EarthCraft Technical Advisor will diagnostically test for compliance with criteria at the final inspection.

ES 4.10 Vent kitchen exhaust fans to exterior ≥100 cfm: electric ranges

Criteria

For each electric range, 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 4.11 Verify outdoor air supply ventilation airflow test within +/- 20% of design values

Criteria

Measure ventilation rates to be within +/- 20% of design rate.

Confirmation

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

ES 4.12 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 4.13 Supply and exhaust fans rated at ≤3 sones (intermittent) and ≤1 sone (continuous)

Criteria

Install intermittent supply and exhaust fans that are rated at less than 3 sones by manufacturer, unless rated flow is greater than 400 cfm.

Install continuous supply and exhaust fans that are rated at less than 1 sone by manufacturer.

Clarifications

HVAC and remote-mounted fans (i.e., fans with 4 ft. or more of ductwork between the fan and intake grill and outside of habitable spaces, bathrooms, toilets, and hallways) are exempt from these requirements.

Confirmation

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

ES 4.14 Radon resistant construction

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 Building prior to occupancy***

Test building for radon prior to occupancy according to EPA testing procedures. Disclose test results to potential occupants.

OR

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

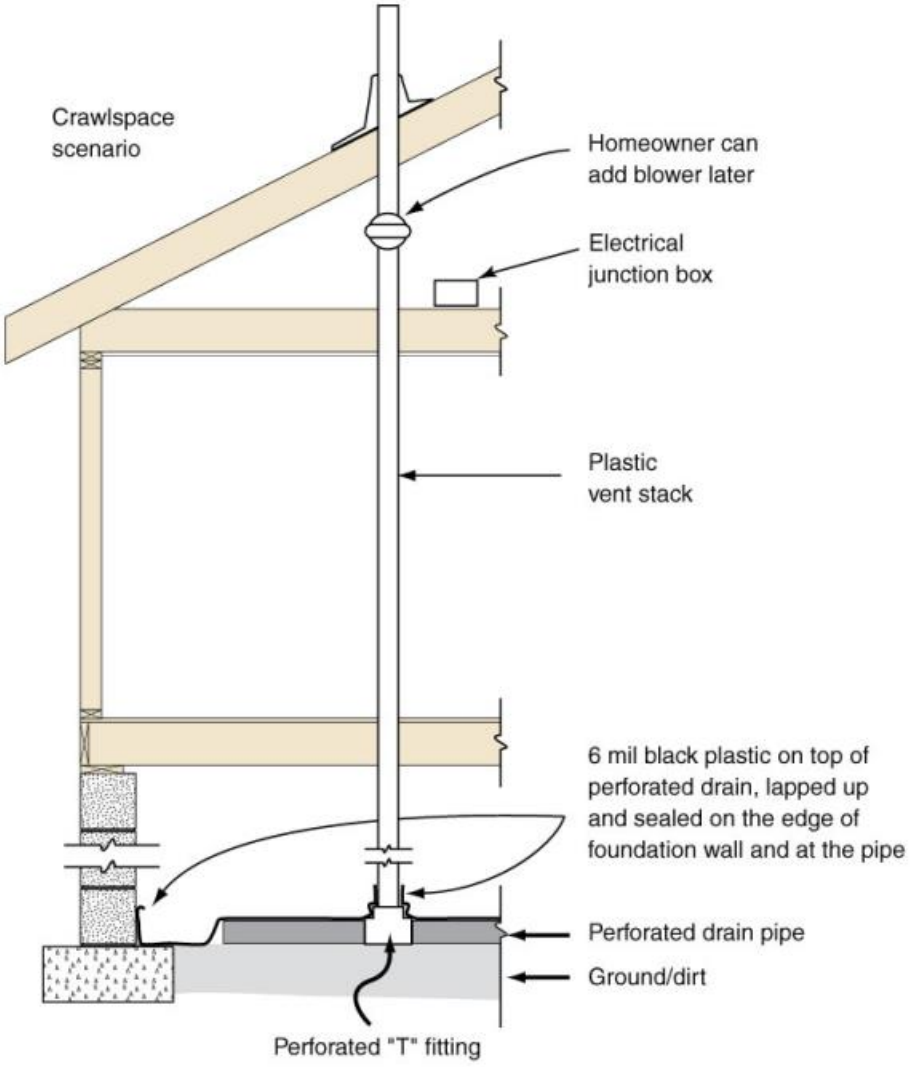


Figure 75: Radon vent pipe

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

Confirmation

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

ES 4.15 Exhaust fan wired with light in bathroom

Criteria

Bath fan must be wired to the lighting system in the bathroom to encourage proper ventilation.

Confirmation

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

ES 4.16 Duct all exhaust fans with rigid duct

Criteria

Duct all exhaust 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 4.17 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 4.18 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 4.19 Vent storage room 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 If gas, direct vent

Criteria
If installing a gas water heater it must be directly vented to the exterior and bring in combustion air from the exterior.

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

ES 5.1 Heat trap on storage water heaters

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 5.2 Electric water heaters ≥ 0.93 EF

Criteria
The minimum efficiency requirement for a water heater is 0.93EF

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

ES 5.3 Pipe insulation on first 2'

Criteria
Water heater must have pipe insulation on the first 2' of hot water supply pipe.

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

ES 5.4 High efficiency water heater

Criteria
Install high efficiency water heater that meets the energy factor (EF) requirements in the following for gas or electric operation:

A. Storage water heater Natural Gas ≥ 0.67 EF, Electric ≥0.95 EF

B. Tankless water heater Natural Gas ≥ 0.90 EF

Install a tankless gas water heater according to manufacturer specifications that meets a minimum of 0.90 energy factor for gas.

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 5.5 Type of water heater

Criteria

A. 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.

B. High efficiency tankless water heater with insulated buffer tank

Install a tankless gas water heater according to manufacturer specifications that meets a minimum of 0.92 energy factor for gas with an insulated buffer tank to reduce water wasted while tankless water heater ramps up to desired hot water temperature.

C. 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.

OR

Install heat recovery water heating (refrigerant-to-water desuperheating coil) according to manufacturer specifications to recover waste heat from an air conditioner or heat pump to heat domestic water.

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 5.6 Hot water pipe 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 conditioned space and therefore do not apply to this criteria.

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

Lighting and Appliances

ES 6.0 High-efficacy lighting in 100% of all permanent fixtures

Criteria
Install high-efficacy lighting in 100% or more of all permanent fixtures. High efficacy lighting includes compact fluorescent 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 townhome 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
Unit TOTAL: 30 fixtures and 60 bulbs

At least 30 bulbs in the unit must be high efficacy.

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

ES 6.1 If installed, ENERGY STAR 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 6.2 If installed, ENERGY STAR 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 ENERGY STAR Advanced Lighting Package

Criteria

Design and construct units 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 EarthCraft Technical Advisor will review documentation provided by the builder for compliance with criteria and will visually confirm compliance with criteria at final inspection.

ES 6.4 Control systems

Criteria

1. Automatic indoor lighting controls

All kitchens, bathrooms, hallways, closets, and utility rooms must have an automatic lighting control system such as a vacancy sensor or timer with manual-on control.

2. Automatic outdoor lighting controls

Control exterior lighting with automatic motion or timer controls that incorporate a photocell to prevent daytime use.

Confirmation

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

ES 6.5 Fixtures and bulbs

Criteria

A. ENERGY STAR qualified compact fluorescent fixtures or LED bulbs (100%)

Install ENERGY STAR qualified compact fluorescent fixtures or LED screw-in bulbs for 100% of all interior lighting.

B. Ballasted compact fluorescent fixtures or LED bulbs at all recessed light fixtures

Install ballasted compact fluorescent fixtures or ENERGY STAR qualified LEDs in all recessed light fixtures.

C. Compact fluorescent bulbs (≥90%)

Install ENERGY STAR qualified screw-in compact fluorescent bulbs for 90% or greater of the interior lighting.

Clarifications

Projects may use a combination of fixtures and bulbs outlined in A, B and C, but can receive credit only on the lower pointed item.

Bulbs in appliances (refrigerators, ovens, etc.) are excluded from the bulb percentage count.

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.

Example

A project with 20% ENERGY STAR qualified compact fluorescent fixtures and 70% ENERGY STAR qualified screw-in compact fluorescent bulbs would qualify for C.

Confirmation

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

Common Area Lighting/Appliances

ES 7.0 Ballasted compact fluorescents and/or LED bulbs in all corridor/ breezeway and all common spaces

Criteria

All lighting in corridor/breezeway and all common spaces must be ballasted compact fluorescents and/or LED bulbs. It can be a combination of both types but must comprise 100 percent of the lighting installed.

Confirmation

- The EarthCraft Technical Advisor will visually confirm compliance with criteria prior to the final inspection.

ES 7.1 If installed, ENERGY STAR qualified clothes washer

Criteria

If installed, all installed clothes washers 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 with criteria to the EarthCraft Technical Advisor prior to the final inspection.

ES 7.2 If installed, High Efficiency clothes dryer with moisture sensor

Criteria

If installed, all clothes dryers must be high efficiency with moisture sensor.

Clarifications

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

Additional Resources

A list of qualified products can be found at:
http://www.appliances.energy.ca.gov/Default.aspx

Confirmation

- The builder must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to the final inspection.

ES 7.3 High-efficiency exterior lighting:

Criteria

Reduce high energy use in exterior lighting environments through improved design practices. The lighting design must account for the following elements:

1. Exterior lighting for walkways and other pedestrian paths;
2. Exterior lighting for parking area lighting;

3. Design must include exterior lighting mounted to the building (wall packs), tenant porch lighting, and lighting at the building entrance/site entrance;
4. To achieve this credit, down lighting controls must be included on all exterior light fixtures (Dark Sky Compliant);
5. Lighting shutoff controls must be included at all possible locations (porches, site, and building).

1. ***Design to reach IES guidelines: Lighting for Exterior Environments***
   Outdoor Lighting must meet IES guidelines (IESNA publication, RP-33-1999).

2. ***Achieve 50% reduction based on Advanced Energy Design Guide (ASHRAE/IES)***
   Outdoor lighting must meet the 50% reduction based on the Advanced Energy Design Guide. (AHSRAE/IES publication, Advanced Energy Design Guide for Small to Medium Office Buildings)

3. ***High-efficiency lighting using 100% fluorescent and/or LED bulbs***
   Outdoor lighting must use 100% fluorescent and/or LED bulbs.

Additional Resources

A list of qualified outdoor lighting products can be found at: http://www.energystar.gov and http://www.darksky.org/outdoorlighting.

Design guidelines can be located at: www.ies.org and www.ashrae.org.

Confirmation

- The lighting designer must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with criteria at final inspection.

ES 7.4 High-efficiency Elevators

Criteria

Elevators installed must meet efficiency criteria of Traction (ThyssenKrupp), MRL (Machine Room- Less), or equivalent elevator systems.

Confirmation

- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with 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 Meet National Energy Policy Act low-flow standards for all fixtures

Criteria

All fixtures must meet the National Energy Policy Act low-flow standards for flow requirements.

Confirmation

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

WE 1.1 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 1.2 If installed, water treatment system NSF certified, ≥85% efficient

Criteria

Any installed drinking water systems must be certified to meet applicable NSF/ANSI standards with a minimum of 85% efficiency rating:

- NSF/ANSI 42 Drinking Water Treatment Units – Aesthetic Effects
- NSF/ANSI 53 Drinking Water Treatment Units – Health Effects
- NSF/ANSI 55 Ultraviolet Microbiological Water Treatment Systems
- NSF/ANSI 58 Reverse Osmosis Drinking Water Treatment Systems
- NSF/ANSI 62 Drinking Water Distillation Systems.

Each system must yield 85 gallons or greater of treated water for each 100 gallons of water processed.

Confirmation

- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with criteria at final inspection.

WE 1.3 If installed, water softeners certified to NSF/ANSI Standard 44

Criteria

Any installed self-regenerating water softeners must be certified to meet NSF/ANSI 44 Residential Caution Exchange Water Softeners, including the voluntary efficiency rating standards in Section 7 – Mandatory testing for elective claims for efficiency rated systems. These standards state that water softeners must:

- Be a demand-initiated regeneration system (i.e., it must use a flow meter or water hardness sensor to initiate regeneration; devices that use time clock-

initiated regeneration [fixed time schedule] do not qualify for the efficiency rating).
- Have a rated salt efficiency of not less than 3,350 grains of total hardness exchange per pound of salt, based on sodium chloride (NaCl) equivalency (477 grams of total hardness exchange per kilogram of salt).
- Not generate more than 5 gallons of water per 1,000 grains of hardness removed during the service cycle (18.9 liters per 64.8 grams of total hardness removed).

Confirmation
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to the final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance with 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, it must be on-demand circulation. Continuous circulation systems and circulation systems with timers are not approved methods. This credit is not applicable to central water heating systems.

Project teams 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

Nominal Pipe or Tube Size (inch)	Liquid Ounces per Foot of Length	Maximum Pipe or Tube Length	
		System without a Circulation Loop or Heat Traced Line (feet)	System with a Circulation Loop or Heat Traced Line (feet)
1/4[a]	0.33	50	16
5/16[a]	0.5	50	16
3/8[a]	0.75	50	16
1/2	1.5	43	16
5/8	2	32	12
3/4	3	21	8
7/8	4	16	6
1	5	13	5
1 1/4	8	8	3
1 1/2	11	6	2
2 or larger	18	4	1

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 project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.

WE 1.5 Low-flow fixtures (units and common facilities)

Criteria

1. ***WaterSense labeled toilet (≤1.28 avg. gal/flush)***

All installed toilets must be WaterSense labeled with an average maximum gallon per flush of 1.28 or less.

2. ***WaterSense labeled urinal (≤0.5 gal/flush)***

All installed urinals must be WaterSense labeled with an average maximum gallon per flush of 0.5 or less.

3. ***WaterSense labeled lavatory faucet and accessories (≤1.5 gpm at 60 psi)***

All installed bathroom sink faucets and accessories must be WaterSense labeled with an average maximum gallon per minute of 1.5 or less at 60 psi.

4. ***WaterSense labeled Showerhead (≤2 gpm)***

All installed showerheads must be WaterSense labeled with an average maximum flow rate of 2 gallons per minute.

Clarifications

Dual-flush toilet average flush rates should be calculated as follows: (2 low flush + 1 high flush)/3.

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 1.6 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 should be calculated as follows: (2 low flush + 1 high flush)/3.

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 1.7 Waterless urinals in common areas, all fixtures

Criteria

All urinals installed in common areas must be waterless.

Confirmation

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

WE 1.8 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.

WE 1.9 Rainwater harvest system for indoor water use

Criteria

Install rainwater harvest system with minimum capacity, to flush at least one primary toilet in each dwelling unit 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.

WE 1.10 Hot water demand ≤0.13 gal of water between loop and fixture and ≤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 1.4.

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.

Outdoor Water 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 property management***

The builder must develop and provide property management 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 property management***

The builder must provide irrigation system layout to property management.

Confirmation

Rain sensor shutoff switch
- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the final inspection.

Manual
- 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.

WE 2.2 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 2.3 Install plants to maintain ≥2' distance from building at maturity

Criteria

Locate all bushes, shrubs, trees, vines, and other vegetation so that at maturity the plantings are ≥2' from 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 building at the time of the final inspection.

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

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

WE 2.4 Turf ≤40% of landscaped area

Criteria

Install turf grass on 40% or less of the landscaped area.

Confirmation

Turf 40% or less of landscaped area
- The EarthCraft Technical Advisor will verbally and visually confirm compliance of criteria with the builder at the final inspection.

WE 2.5 Vegetate slopes exceeding 4:1

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 2.6 If installed, irrigation system

Criteria

1. ***Design, install and audit irrigation system by WaterSense Irrigation Partner with no leaks***

Irrigation system must be designed, installed, and audited by a WaterSense irrigation partner in accordance with the WaterSense program. The system must be checked for leaks by the WaterSense irrigation partner during the post-installation audit.

2. ***Micro-irrigation system (e.g., drip irrigation) includes pressure regulator, filter, and flush end assemblies***

If installed, micro-irrigation system (a low-pressure irrigation systems that sprays, mists, sprinkles, or drips) includes a pressure regulator, filter and flush end assemblies.

3. ***Distribution uniformity ≥65% lower quarter***

Irrigation systems must achieve lower quarter distribution uniformity (DU_{LQ}) of 65 percent or greater. Measure the distribution uniformity on the largest spray-irrigated area during the post-installation audit.

4. ***Install sprinklers only on turfgrass, 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.

5. ***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 EarthCraft Technical Advisor will visually confirm compliance of criteria at final inspection.

Items 1 and 3 only

- 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 2.7 Drought-tolerant/native landscaping turf and plants

Criteria

Install 85% 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 2.8 Xeriscape ™ guidebook given to property management or owner

Criteria

A drought tolerant landscape plan developed by a landscape architect, horticulturist, or other professional shall be provided to the property management staff or landscaper. A copy of Virginia Tech's Cooperative Extension guide, "Creating a Water-Wise Landscape" given to the property management staff or landscaper.

Additional Resources

The Virginia Tech Cooperative Extension guide, "Creating a Water-Wise Landscape" can be found at http://pubs.ext.vt.edu/426/426-713/426-713_pdf.pdf

Confirmation

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

WE 2.9 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 2.10 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 building.

3. 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. Microirrigation should be installed on separate zones from the rest of the irrigation system if sprinkler heads are used in other parts of the landscape.

4. 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).

Clarifications

For multifamily projects, water captured from HVAC condensate drain may be used to meet the intent of #2 listed above.

WE 2.11 Timer on exterior water spigots

Criteria

Install timer on all exterior water spigots.

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

Education and Operations

Education

The best designed and constructed building can still be inefficient if the resident does not utilize its high performance benefits properly. The Education and Operations category provides strategies for informing residents of the benefits of an EarthCraft house as well as how to best use energy efficient features to maximize efficiency. Improved occupant education may lead to fewer comfort complaints and call backs in green projects.

EO 1.0 Provide property management with project-specific owner's manual

Criteria

Provide property management with project-specific owner's manual. Manual must contain, at a minimum, the following information:

- General
  - The final EarthCraft Worksheet for the project with cover sheet, and a copy of the EarthCraft certificate for the project.
- 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 project as well as a list of haulers that provide curbside service.
- Credit Specific Items requiring operating manuals/instructions:
  - DU 1.13 Alternative termite treatment with no soil pretreatment
  - ES 4.2 Install outside air intake with ventilation CFM, damper and controls meeting ASHRAE 62.2-2007 ventilation requirements
  - ES 4.15 Automatic bathroom exhaust fan controls
  - WE 2.1-2 & 3 Irrigation system
  - EO 3.1 Indoor airPLUS
  - EO 3.2 WaterSense New Home

- Credit Specific Items requiring warranty information:
  - DU 1.14-3 Mold inhibitor with warranty applied to all lumber
  - DU 1.17 Exterior cladding with 30-year warranty
  - DU 1.18 Windows, doors and skylights with ≥ 25-year warranty
  - DU 1.21-A & B Roofing warranty

Clarifications
Equipment manuals are acceptable, but should be supplemented with clear and specific instructions to the tenant on when and how equipment should 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 units 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 Local recycling contact

Criteria
Provide residents a location for local recycling if recycling is not collected on site.

Clarification
The project team will not achieve points if recycling is completed by the local municipality or if the project team provides a recycling center on site.

Confirmation
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria.

EO 1.2 Label all storm drain or storm inlets to discourage dumping of pollutants

Criteria
Label each storm drain within the development to discourage tenants from dumping pollutants in storm drains.

Clarification
Find more information about labeling storm drains here: http://www.cbf.org/join-us/education-program/resources/storm-drain-stenciling

Confirmation
- The EarthCraft Technical Advisor will visually verify for compliance during final inspections.

EO 1.3 Household hazardous waste resources

Criteria

The property management team must provide the tenant with a copy of hazardous cleaning material products and suggest environmentally preferable alternatives to common but harmful cleaning products.

Property management must include environmentally preferable products in their own protocols for purchase of cleaning supplies.

Confirmation

- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor prior to the final inspection.

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 buildings certified under the program, the program has 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 Provide all subcontractors with EarthCraft Multifamily worksheets

Criteria

Provide and review the relevant EarthCraft Multifamily measures with each subcontractor to ensure their compliance with the program guidelines.

Confirmation

- The EarthCraft Technical Advisor will verbally confirm compliance with criteria with the project team at the pre-drywall and final inspections.

EO 2.1 Property Maintenance Staff representative attends design review and/or kick off meeting

Criteria

Property Maintenance Staff representative attends design review and/or kick off meeting.

Confirmation

- The EarthCraft Technical Advisor will verbally confirm compliance with criteria with the project team at the design review and/or kick off meeting

EO 2.2 Market EarthCraft Multifamily program

Criteria

Include the EarthCraft Multifamily logo in all print materials, websites, advertisements and other promotional materials associated with project promotion.

Post an EarthCraft Multifamily sign during construction that is visible from the site entrance.

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

EO 2.3 Provide pre-occupancy briefing for tenant

Criteria

Provide pre-occupancy briefing for all tenants. Walk through main green features of the unit and inform tenant on proper use of programmable thermostat, HVAC system and all major appliances in the unit.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance with criteria with the project team upon reviewing the pre-occupancy briefing plan.

EO 2.4 Project participates in post occupancy project debriefing

Criteria

Project team (maintenance, management staff, and owner) participates in post occupancy project debriefing to review the final worksheet and primary green building features of the project.

Confirmation
- The EarthCraft Technical Advisor will verbally confirm compliance with criteria with the project team upon attendance at post occupancy project debriefing.

EO 2.5 Environmental management and building maintenance guidelines for property management staff

Criteria

The property management group must develop and utilize maintenance guidelines related to the green features of the project. These features must include all energy and water efficiency features of the units and common spaces. The goal of these guidelines will be to promote improved maintenance of the buildings sustainable features.

Confirmation
- The project team must present management guideline documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the final inspection.

EO 2.6 Landscape maintenance guide for maintenance and management personnel

Criteria

The property management group must develop and utilize landscape maintenance guidelines for maintenance and management staff. The goal of these guidelines will be to promote proper maintenance of the landscaping.

Confirmation
- The project team must present the landscape management guideline documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the final inspection.

Third Party Programs

EO 3.0 ENERGY STAR Qualified New Home or ENERGY STAR MFHR

Criteria

Construct and certify project in accordance with current ENERGY STAR qualified new home specifications. Complete all necessary steps to qualify project under ENERGY STAR, including all checklists and inspections.

Clarifications

Project team must be an active ENERGY STAR Partner and complete the online ENERGY STAR Orientation Training to be eligible to build homes qualified under current ENERGY STAR version.

HVAC contractors must complete the current ENERGY STAR training and be credentialed through an EPA–recognized industry organization.

Additional Resources

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

Confirmation

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

EO 3.1 Indoor airPLUS

Criteria

Construct and certify project 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 project team must submit documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection and final inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will diagnostically test for compliance with criteria at the pre-drywall inspection and final inspection.

EO 3.2 WaterSense New Homes

Criteria

To label a project as a WaterSense New Home, the builder must sign a WaterSense partnership agreement, build the project to WaterSense specifications, submit the project for inspection by a certified WaterSense Inspector, and pass inspection. The builder must also 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

For more information about EPA's Water Sense Homes program see: www.epa.gov/WaterSense.

Confirmation

- The builder must submit documentation demonstrating compliance with 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 with criteria and will diagnostically test for compliance with criteria at the pre-drywall inspection and final inspection.

EO 3.3 EarthCraft Community Certification

Criteria

Build the project in an EarthCraft Community.

Clarifications

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

Additional Resources

For more information, visit http://www.earthcraft.org/earthcraft-programs.

Confirmation

- The EarthCraft Technical Advisor will verbally confirm compliance with criteria with the project team at the final inspection.

EO 3.4 EarthCraft Light Commercial for Community Center

Criteria

Certify the project's Community Center under the EarthCraft Light Commercial program.

Additional Resources

For more information, visit http://www.earthcraft.org/light-commercial

Confirmation

- The EarthCraft Technical Advisor will confirm EarthCraft Light Commercial certification achieved at the final inspection.

EO 3.5 EarthCraft Light Commercial Ready Spaces

Criteria

For mixed-use developments that include both residential units and commercial retail spaces sharing the same building shell, meet the following criteria in order to designate the retail tenant spaces as EarthCraft Light Commercial Ready (ECLC Ready):

- Owner must agree to a smoking policy within retail corridors and other shared public spaces within the building and designate public smoking areas at least 25 feet away from all retail entrances and exits
- Apply minimum thermal break of R-2 for steel stud framing regardless of climate zone (no trade-offs allowed)
- Tenant partition walls must be insulated to a minimum of R-13
- Meet or exceed ASHRAE 90.1-2007 Energy Standard for the following commercial building components: walls, ceilings, floors, and glass
- Submit the following Energy Code Compliance Documentation:
    - Use Prescriptive values in ASHRAE 90.1-2007 Climate Zone Table for project's respective Climate Zone – or – use COMcheck Software to demonstrate compliance via a Trade-off Approach
    - Visual inspection of envelope components at pre-drywall, including glass U-factor and SHGC via NFRC labels and/or certification of compliance for storefront glass (within its assembly)
- Meet the following air sealing and insulation requirements:
    - Exterior walls, corridor walls, and tenant partition walls and penetrations must be air sealed to reduced air connectivity between retail tenant and other adjacent spaces
    - Ceiling chases within the tenant space to other spaces must be sealed air tight at tenant build-out completion
    - All installed ductwork must meet EarthCraft Multifamily/EarthCraft Light Commercial requirements for air sealing (mastic or mastic paste)
    - Insulation must meet Grade 2 level installation
- Locate outside air intakes 15 feet away from moderate contaminant sources (such as exhaust outlets, garbage pick-up/dumpster areas, and garage entries) and 25 feet away from high contaminant sources (such as truck loading docks, vehicle idling, and high vehicle traffic areas).
    - All retail tenant air intakes must be a least 10 feet away from contaminate sources and air intakes must draw air from the outside and be fully ducted to the building envelope
- Installed Lighting, HVAC, and Ductwork must meet or exceed ASHRAE 90.1-2007 Energy Standard
- Must meet ASHRAE 62.1-2007, Ventilation for Acceptable Indoor Air Quality for all applicable areas within the project scope

Clarification

All projects that intend to seek ECLC Ready Spaces must pre-qualify with an EarthCraft Light Commercial approved EarthCraft Technical Advisor.

For projects Additional Resources

For information on ASHRAE 90.1-2007 and ASHRAE 62.1-2007, visit American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) website at www.ashrae.org.

To download free COMcheck Software, visit www.energycodes.gov.

For more information on meeting ASHRAE referenced standards and minimum envelope requirements for light commercial spaces, refer to the EarthCraft Light Commercial Technical Guidelines, downloadable for free at: www.earthcraft.org/light-commercial.

Confirmation

- Provide applicable signed COMcheck compliance certificates and COMcheck File to prior to Pre-Construction Meeting
- Provide Certificate of Compliance for storefront glass (as applicable)
- Pre-drywall and Final Inspections by an EarthCraft Light Commercial approved EarthCraft Technical Advisor to view air sealing measures, applied insulation, glazing, and installed ductwork

EO 3.6 Building America Builder's Challenge

Criteria

Construct and certify project according to the requirements in the Building America Builder's Challenge program.

Additional Resources

For more information, see www1.eere.energy.gov/buildings/challenge.

Confirmation

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

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 building and reward those implementing cutting-edge technologies. Builders are encouraged to present products, technologies, and strategies not covered elsewhere within the EarthCraft program.

IN 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 project.

Confirmation

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

IN 1.1 Solar, micro-hydro or wind electric system

Criteria

Install on-site solar, micro-hydro, or wind electric system to provide energy (in the form of heat and/or electricity) to project.

Confirmation

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

IN 1.2 Solar-ready design

Criteria

Design and construct project 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 building(s) electrical load. The space must allow the array to remain un-shaded 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 project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor at the pre-drywall inspection.
- The EarthCraft Technical Advisor will review documentation provided by the project team for compliance with criteria and will visually confirm compliance at pre-drywall and final inspections.

IN 1.3 Solar electric system (10% of project demand)

Criteria

The project will utilize a solar electric array with the capacity to offset 10% of electrical load demand required by all building(s) within the development. This power may be directly tied to the building(s) common areas and units or may be transferred to the grid.

Clarifications

To qualify, the project team must clearly indicate the expected electrical load requirements of the building(s) within the development and then provide a solar PV design showing that 10% of that demand is attainable.

Efficient lighting strategies (outlined in IES/ASHRAE design guidelines, see ES 7.2) are encouraged as a first step, in order to reduce the overall electrical load requirement before installing the required 10% PV capacity at final design.

Confirmation
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor.

The documentation must include:
1. A letter from the solar designer/installer indicating the kwh production of the solar system installed.
2. The electrical engineer must indicate the total expected electric capacity of the entire building(s) in the project.
3. If tied to the grid, the project team must provide details of the agreement with the power provider.

IN 1.4 100% of stormwater kept on site and used for development operations

Criteria
The project prevents 100% of the stormwater from entering the main sewer system by storing it on site to be used in the building/development operations.

Clarifications
To qualify, all stormwater must be stored on site and used in the building/development operations.

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

IN 1.5 Common areas use solar electric system (80% of demand)

Criteria
The project will utilize a solar electric array with the capacity to offset 80% of electrical load demand required by all common areas within the building(s). This power may be directly tied to the building or may be transferred to the grid.

Clarifications
To qualify, the project team must clearly indicate the expected electrical load requirements of all common areas (including but not limited to clubhouses, offices, hallways, laundry facilities, bathrooms, outdoor common areas, etc.) and then provide a solar PV design showing that 80% of that demand is attainable.

Efficient lighting strategies and controls (outlined in IES/ASHRAE design guidelines, see ES 7.2) are encouraged as a first step in order to reduce the overall electrical load requirement before installing the required 80% PV capacity at final design.

Confirmation
- The project team must present documentation demonstrating compliance with criteria to the EarthCraft Technical Advisor.

The documentation must include:
1. A letter from the solar designer/installer indicating the kwh production of the solar system installed.
2. The electrical engineer must indicate the total expected electric capacity of all common areas within the project.
3. If tied to the grid, the project team must provide details of the agreement with the power provider.

IN 1.6 Housing affordability

Criteria
A percentage of total housing units within the project are reserved for tenants qualifying for a low-income housing assistance program.

A.≥20% total units

B.≥50% total units

Confirmation
- The project team will submit details of affordable housing funding mechanism and the numbers of units qualifying as affordable within the entire development.

IN 1.7 Developer contracts for at least 12 months post construction energy monitoring

Criteria
Upon certification, the developer will contract for at least 12 months of post construction energy monitoring.

Confirmation
- The EarthCraft Technical Advisor will confirm compliance and the developer will share the 12 month study results with EarthCraft upon completion.

IN 1.8 Project-specific innovation points

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.