



## Builders Challenge Quality Criteria Guide – Version 1.3

The Builders Challenge Quality Criteria are designed to promote continuous improvement while ensuring construction quality and efficiency so builders and homeowners alike benefit from reduced callbacks and enhanced comfort, indoor environmental quality, and durability. To qualify for the Builders Challenge all homes, regardless of compliance pathway, must comply with the Quality Criteria and the Energy Performance threshold, as well as meet all applicable codes.

This version of the Quality Criteria is subject to revision. Registered builders will be notified of revisions and all projects built after a revision must comply with the updated criteria. Items which are not currently listed as “Required” are still Recommended. Technical resources on constructing high performance homes are available on the Builders Challenge website ([www.buildingamerica.gov/challenge](http://www.buildingamerica.gov/challenge)).

### Relationship to Codes & Manufacturer Requirements

The Quality Criteria are not intended to supplant safety, health, or environmental requirements contained in other applicable codes or ordinances, and all locally applicable codes apply. In cases where a locally applicable code requirement is more stringent or is in conflict with a quality criterion, the local provision shall apply. Many of the provisions noted below are basic code requirements in the most current energy codes. By including these items as Quality Criteria, the Builders Challenge is focusing attention on their proper implementation.

Additionally, where a quality provision is in conflict with the manufacturer’s requirements for a product – the manufacturer’s requirements shall apply.

### Roles and Responsibilities

The Quality Criteria require different parties to conduct, confirm, and/or verify good building practices for Builders Challenge homes.

**Builders** must establish the expectations for quality practices, oversee their implementation, and keep records to confirm what was done. These responsibilities are noted below.

**Third-party verifiers** must verify the implementation of the Quality Criteria (QC) either directly, by means of an actual measurement or inspection, or by confirming that the builder implemented the QC. RESNET-certified HERS raters and DOE Building Consortia team members qualify as third-party verifiers for the Builders Challenge. DOE will work with the NAHB Research Center to establish a process by which NAHB third-party verifiers can qualify to conduct QC inspections for homes qualifying for the Builders Challenge. Other professionals may be eligible to serve as verifiers, such as licensed engineers and architects or employees or authorized representatives of a utility or local building regulatory authority, if they have been trained by RESNET (or an equivalent organization) to use building performance testing methods and tools. Such professionals will be approved by DOE.



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Trade contractors must implement quality practices in accordance with their scope of work. More information on quality training is available on the Builders Challenge website.

## Resources

A technical resource guide with background on each of the QC provisions below, based on the Building America Best Practice Guides, is currently under development. Links to the Building America Best Practice Guides, as well as other technical resources, are posted on the Builders Challenge website.

## Quality Criteria

The Quality Criteria are listed in three phases:

The **Design Phase** requires design, planning and documentation before construction.

The **Construction Phase** frequently requires the builder/superintendent to visually inspect and document proper installation by the trade contractors.

The **Verification Phase** requires a third-party verifier to review and measure criteria after construction.

Builders Challenge Quality Criteria	Builder Documentation & Verification Requirements	Third-Party Verification Requirements
<p><b>1. <u>Project Documentation – Required</u></b></p> <p>Construction/design documentation (e.g., plans, details, specifications, job ready and job complete checklists, and trade scopes of work and/or agreements) will include energy and quality provisions needed to meet the Builders Challenge criteria.</p>	<p>Develop and store construction/design and energy rating documentation in project records.</p> <p>The builder (or builder’s representative) shall review the adequacy of the construction/design documentation for implementing the energy and quality provisions, and shall sign the completed checklists.</p>	<p>The third-party rater shall review the construction documentation and signed checklists.</p>
<p><b>2. <u>Building Envelope Moisture Management – Design Phase - Required</u></b></p> <p>In the design phase, include details for integrating the weather barrier system with flashing components in the construction plans. Specify window and door flashing based</p>	<p>Develop construction plans with flashing details, foundation details, vapor retarder</p>	<p>Verify that construction plans contain specifications</p>



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<p>on the Building America Best Practices (Trades section), or such references as the Water Management Guide (EEBA), the latest version of ASTM E-2112, the AAMA Installation Standard, or manufacturer's recommendations.</p> <p>Provide details to provide adequate site and below-grade drainage, and to prevent moisture from entering the building from below grade by capillary flow. Typically, this would require the builder to specify a foundation drainage system with capillary breaks below the slab, between the footer and foundation, and between the foundation wall and sill plate.</p> <p>Specify climate appropriate vapor retarder or barrier per locally applicable IECC. (Reference IECC Section 402.5)</p> <p>When using water absorptive cladding, including brick, stone (real or manufactured), stucco, and fiber cement, provide a pathway for bulk water that enters the wall assembly from the exterior to drain to the exterior. Typically this involves specifying a drainage space or pathway provided by furring strips, an air gap, contoured house wrap, or other products that create a vertical drainage channel behind the cladding and exit the wall horizontally. Cladding installation per manufacturer's recommendations is also permitted.</p>	<p>specification, and drainage space specification (if applicable)</p> <p>Include requirements for flashing, foundation details, and wall system details in contractor's construction/design documentation.</p>	
<p><b>3. <u>Material Efficient Framing – Recommended</u></b></p> <p>Design building dimensions and layouts to minimize material cuts and waste for wall, floor, and roof system structural components and sheathing. Size all headers for actual structural loads, and insulate to the fullest extent possible. To the extent possible use building systems which minimize on-site waste, such as panelized walls, pre-cut framing packages, and engineered wood products. Incorporate these measures in the framing</p>	<p>Develop framing layout plan and keep in project records.</p>	

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layout plan.		
<p>4. <u>Construction Waste Management – Recommended</u></p> <p>Develop, post at the jobsite and implement a Construction Waste Management Plan. The plan should document the diversion pathways for major waste stream components including cardboard, lumber, land-clearing debris, and drywall. The plan should also document efforts to request minimized packaging from suppliers. Goals for waste diversion should be at least 25% (by weight) for construction and land-clearing waste.</p>	<p>Develop Construction Waste Management Plan and keep in project records.</p>	
<p>5. <u>Space Conditioning Design – Required</u></p> <p>Right-size space conditioning system for heating/cooling loads based on ACCA Manual J Version 8 or comparable load sizing analysis (reference 2006 IRC M1401.3, 2006 IECC Section 403.6). The maximum over-sizing limit for cooling equipment is 15%, with the exception of heat pumps in Climate Zones 5 - 8 where the maximum over-sizing limit is 25%. Outdoor temperatures shall be the 99.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home’s location or most representative city for which design temperature data are available. Note that a higher outdoor air design temperature may be used if it represents prevailing local practice by the HVAC industry and reflects extreme climate conditions that can be documented with recorded weather data; Indoor temperatures shall be 75 F for cooling; Infiltration rate shall be selected as “tight”, or the equivalent term. In specifying equipment, the next available size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI standards.</p> <p>Identify the whole building ventilation strategy and equipment in the mechanical system design (see the 2 other Quality Criteria: Whole Building Ventilation I and II for requirements).</p> <p>6. <u>Space Conditioning Design – Recommended</u></p>	<p>Analyze load-sizing and duct-sizing and keep in project records.</p>	<p>Review the load-sizing and duct-sizing analyses to ensure that sizing criteria stated in the requirements were used for the home.</p>

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Design and install duct system(s) using ACCA Manual D or equivalent. Integrate HVAC duct layout with construction documentation. Select heating/cooling equipment using ACCA Manual S or equivalent.		
<p><b>7. <u>Dehumidification – Recommended</u></b></p> <p>Install equipment with sufficient latent capacity to maintain indoor relative humidity at or below 60% in Climate Zones 1A, 2A, 3A and 4A, as defined by the 2006 IECC Figure 301.1. This requirement can be met with an additional dehumidification system or a central HVAC system equipped with additional controls to operate in dehumidification mode.</p>	Include mechanical specifications for dehumidification in construction documents and keep in project records.	
<p><b>8. <u>Space-Conditioning System Installation - Recommended</u></b></p> <p>Space-conditioning system installation meets ACCA Quality Installation Specification.</p>		
<p><b>9. <u>Building Envelope Pressurization Testing – Recommended</u></b></p> <p>Test envelope leakage to <math>\leq 0.35</math> cfm per square foot of building envelope area at a pressure differential of 50 Pascals between the house interior and outdoors. (See QC provision: Air Barrier and Insulation Integrity).</p>		Test envelope leakage to be below specified limit, using a RESNET-approved testing protocol.
<p><b>10. <u>Windows – Required</u></b></p> <p>Specify ENERGY STAR qualified windows or better.</p>	Include in specification and keep in project records.	Verify installation of ENERGY STAR qualified windows.
<p><b>11. <u>Whole Building Mechanical Ventilation I - Required</u></b></p> <p>Design and install a mechanical system(s) to provide outside air to the indoor environment through either exhaust, supply, or balanced ventilation. Equip outside air intakes for ventilation with filters and shutoff dampers. (Also see QC Provision: Whole Building Mechanical Ventilation II – which is a recommended measure).</p>	Include in mechanical plans and keep in project records.	Verify the installation of a whole building MV system.
<p><b>12. <u>Kitchen Ventilation – Required</u></b></p> <p>Provide mechanical kitchen ventilation with an exhaust fan(s) that can provide at least 100 cfm intermittent (reference 2006 IRC M1507.3) or airflow equivalent to 5 air changes per hour based on the kitchen volume (continuous use). Fans are vented to exhaust</p>	Include kitchen ventilation requirements in construction documents.	Verify the installation of kitchen ventilation system which exhausts air to outdoors

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kitchen air to outdoors. Refer to Section 6.4 of ASHRAE 62.2-2007 “Combustion and Solid-Fuel Burning Appliances” for information on providing for adequate combustion air for combustion appliances.		
<p><b>13. <u>Bathroom Ventilation – Required</u></b></p> <p>Include mechanical ventilation for all bathrooms with a bathtub, shower, spa, or similar source of moisture with an exhaust fan(s) that can provide at least 50 cfm (intermittent use) or 20 cfm (continuous use). For bathrooms without a bathtub, shower, spa, or similar source of moisture, exhaust ventilation is provided at these same rates, or the room has a window with an openable area of at least 4% of the floor area and no smaller than 1.5 square feet. All bathroom fans are vented to outdoors.</p>	Include in construction documents.	Verify the installation of bathroom ventilation equipment which exhausts air to outdoors
<p><b>14. <u>Clothes Dryer Venting – Required</u></b></p> <p>Clothes dryer vented directly to the outdoors. (reference 2006 IRC M1502.1) Condensing dryers are exempt.</p>	Provide for ducting to the outdoors for clothes dryers.	Verify the installation of a clothes dryer exhaust port to outdoors.
<p><b>15. <u>Duct Leakage – Required</u></b></p> <p>Comply with 15A or 15B, and 15C.</p> <p>15A. Duct leakage to outdoors is less than 5% of conditioned floor area when measured at 25 Pascal using duct pressurization methods.</p> <p>OR</p> <p>15B. All duct work is located within the conditioned envelope (meaning the air barrier and thermal barrier) of the house.</p> <p>AND</p> <p>15C. Total duct leakage is less than 10% of conditioned floor area when measured at 25 Pascals using duct pressurization methods.</p>		<p>Test duct leakage to outdoors to be below specified leakage limits, using a RESNET-approved testing protocol.</p> <p>Verify that ducts are located within the thermal envelope of the house, if Option 15B is selected.</p>
<p><b>16. <u>Air Barrier and Insulation Integrity - Required</u></b></p> <p>Complete the ENERGY STAR Thermal Bypass Inspection Checklist for the home. A link to</p>	Either builder or third-party verifier may complete the checklist.	Either builder or third-party verifier may complete the checklist.



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<p>this checklist is listed on the Builders Challenge website  <a href="http://www.buildingamerica.gov/builderschallenge">www.buildingamerica.gov/builderschallenge</a></p>	<p>Builder must keep signed copy of the checklist in builder's project records</p>	<p>Third-party verifier must confirm that a signed checklist has been completed.</p>
<p><b>17. <u>Filtration - Required</u></b>            Equip the central air handler(s) with a MERV 8 filter or higher. Account for the associated pressure drop from the filter in the design and sizing of the duct work.</p>		<p>Verify the installation of a MERV 8 or higher filter.</p>
<p><b>18. <u>Combustion Safety - Required</u></b>            Fossil fuel-fired furnaces or water heaters installed in conditioned spaces must be sealed combustion, direct vented, or power-vented units.</p>		<p>Verify that combustion-based furnaces and water heaters are direct vented or power vented, if installed in conditioned space.</p>
<p><b>19. <u>Carbon Monoxide - Required</u></b>            For homes with combustion appliance(s) or an attached garage, install at least one carbon monoxide (CO) alarm in a central location outside of each separate sleeping area in the immediate vicinity of the bedrooms. Place them according to NFPA 720 or manufacturers recommendations. They must be hard-wired with a battery back-up function. The alarm devices shall be certified by either CSA 6.19-01 or UL 2034.</p> <p><b>20. <u>Carbon Monoxide - Recommended</u></b>            For all homes, install at least one carbon monoxide (CO) alarm in a central location outside of each separate sleeping area in the immediate vicinity of the bedrooms. Place them according to NFPA 720. They must be hard-wired with a battery back-up function. The alarm devices shall be certified by either CSA 6.19-01 or UL 2034.</p>		<p>Verify the installation of a CO alarm.</p>
<p><b>21. <u>Garage Exhaust Ventilation – Recommended</u></b>            Ventilate attached garages with a 100 cfm (ducted) or 80 cfm (un-ducted) exhaust fan, venting to outdoors and designed for continuous operation. Alternatively, automatic fan</p>	<p>Include in construction plans and contractors' work scopes</p>	



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controls may be installed that activate the fan whenever garage is occupied, and for at least 1 hour after garage is vacated.		
<p><b>22. <u>Air Handler Location - Required</u></b></p> <p>Central air handler(s) is isolated from the garage by a thermal barrier and an air barrier.</p>		Verify air handler location.
<p><b>23. <u>Building Envelope Moisture Management – Field Verification - Required</u></b></p> <p>Flashing details, foundation details, vapor barrier selection, and water drainage space details noted in “Building Envelope Moisture Management” are installed per construction plans and specifications.</p>	Builder documents that measures were implemented with a checklist or other written documentation kept in builder’s project records	Verify that builder has written documentation of implementation
<p><b>24. <u>Energy Star Equipment - Recommended</u></b></p> <p>For equipment included in the sale of the home, use ENERGY STAR qualified appliances and equipment (including HVAC systems).</p>		Verify that appliances are ENERGY STAR qualified, if included in sale of home
<p><b>25. <u>Whole Building Mechanical Ventilation II - Recommended</u></b></p> <p>Install a whole building mechanical ventilation system complying with the requirements of ASHRAE 62.2-2007. Whole building ventilation systems may consist of an exhaust system, supply system, or balanced system, and must be capable of providing the outside air rates specified in Standard 62.2-2007. Refer to Section 6.4 of ASHRAE 62.2-2007 “Combustion and Solid-Fuel Burning Appliances” for information on providing for adequate combustion air for combustion appliances. (Also see QC Provision: Whole Building Mechanical Ventilation I – which is a required measure).</p>	Include mechanical plans which include systems for whole building MV in project records	
<p><b>26. <u>Pressure Balancing - Recommended</u></b></p> <p>All rooms in the conditioned space of the home do not exceed +/- 3 Pascals pressure difference relative to the central (open) areas of the home, when interior doors are closed and the central air handler is operating. Powder rooms and laundry rooms are exempt.</p> <p>OR</p> <p>Return ducts or transfer grilles are installed in every room with a door to which</p>	Pressure testing record is kept in builder’s project records (if measure is implemented)	



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conditioned air is supplied, except for bathrooms, closets, pantries, and laundry rooms.		
<p><b>27. <u>Low VOC Interior Coatings - Recommended</u></b></p> <p>Paints, coatings, and primers applied to interior walls and ceilings have VOC levels of no more than 50 g/L (flats) or 150 g/L (non-flats). (reference LEED for Homes MR Credit 2.2)</p>	Keep specifications in project record	
<p><b>28. <u>Low VOC Adhesives - Recommended</u></b></p> <p>Adhesives comply with the following maximum limits for VOCs:</p> <p>Carpet pad adhesives: 50 g/L (excluding water)</p> <p>Indoor carpet adhesives: 50 g/L (excluding water)</p> <p>Wood flooring adhesives: 100 g/L (excluding water)</p> <p>Subflooring adhesives: 50 g/L (excluding water)</p> <p>Multi-purpose construction adhesives: 70 g/L (excluding water)</p> <p>(reference LEED for Homes MR Credit 2.2)</p>	Keep specifications in builder's project record.	
<p><b>29. <u>Low Emission Cabinets - Recommended</u></b></p> <p>Kitchen and bath vanity cabinets are in accordance with one of the following.</p> <p>(1) Installed kitchen and bath vanity cabinets comply with the Kitchen Cabinet Manufacturers Association Environmental Stewardship Program 01-06</p> <p>(2) Installed kitchen and bath vanity cabinets are in accordance with the CARB standard for urea formaldehyde emissions in composite wood</p> <p>(3) Installed kitchen and bath vanity cabinets contain no added urea formaldehyde or comply with GREENGUARD testing protocol and emission standards (ASTM D 6670) or equivalent. (reference National Green Building Standard 901.10)</p>		