## Thermal Enclosure System

### 1. High-Performance Fenestration & Insulation

<table>
<thead>
<tr>
<th>Item</th>
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<th>Builder Verified</th>
<th>Rater Verified</th>
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### 2. Fully-Aligned Air Barriers

- At each insulated location below, a complete air barrier is provided that is fully aligned as follows:
- Ceiling: At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays).
- Floors: At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. Alternatives in Footnotes 12 & 13.
- Walls: At exterior vertical surface in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8.
- Attic knee walls.
- Walls behind showers.
- Attic knee walls and skylight shaft walls.
- Walls adjoining porch roofs or garages.
- Double-walls and all other exterior walls.

### 3. Reduced Thermal Bridging

<table>
<thead>
<tr>
<th>Item</th>
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### 4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material)

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<thead>
<tr>
<th>Item</th>
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ENERGY STAR Single-Family New Homes
National Rater Field Checklist, Version 3 / 3.1 / 3.2 (Rev. 124)

5. Heating & Cooling Equipment - Complete Track A - HVAC Grading 32 or Track B - HVAC Credential 33

<table>
<thead>
<tr>
<th>Track A</th>
<th>Track B</th>
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<tbody>
<tr>
<td>5a.1 Blower fan volumetric airflow is Grade I or II per ANSI / RESNET / ACCA / ICC Std.-310.</td>
<td>5b.1 HVAC manufacturer &amp; model number on installed equipment matches either of the following (check □ National HVAC Design Report □ Written approval received from designer)</td>
</tr>
<tr>
<td>5a.2 Blower fan watt draw is Grade I or II per ANSI / RESNET / ACCA / ICC Std.-310.</td>
<td>5b.2 External static pressure measured by Rater at contractor-provided test locations and documented Return-Side External Static Pressure: _______ IWC Supply-Side External Static Pressure: _______ IWC</td>
</tr>
<tr>
<td>5a.3 Refrigerant charge is Grade I per ANSI / RESNET / ACCA / ICC Std.-310. See Footnote 3433 for</td>
<td>5b.3 Permitted, but not required: National HVAC Commissioning Checklist collected, with no items left blank.</td>
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6. Duct Quality Installation (Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote)

6.1 Ductwork installed without kinks, sharp bends, compressions, or excessive coiled flexible ductwork. 3726

6.2 Bedrooms pressure-balanced (e.g., using transfer grilles, jump ducts, dedicated return ducts, undercut doors) to achieve a Rater-measured pressure differential ≥ -3 Pa and ≤ +3 Pa with respect to the main body of the house when all air handlers are operating. Test configuration and an alternative compliance option in Footnote 3837.

6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to ≥ R-6

6.4 Rater-measured total duct leakage meets one of the following two options. Alternative in Footnote 4140: 4043, 4140, 4142
6.4.1 Rough-in: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25, with air handler & all ducts, building cavities used as ducts, & duct boots installed. All duct boots sealed to finished surface, Rater-verified at final.
6.4.2 Final: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM25, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles of the finished surface (e.g., drywall, floor) installed. 4444
6.5 Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25. 5959

7. Dwelling Unit Mechanical Ventilation Systems (“Vent System”) 4548 & Inlets in Return Duct 4746

7.1 Rater-measured ventilation rate is within either ± 15 CFM or ±15% of design report value. 5443

7.2 A readily-accessible ventilation override control installed and also labeled if its function is not obvious (e.g., a label is required for a toggle wall switch, but not for a switch that’s on the ventilation equipment). 4346

7.6 If Vent System controller operates the HVAC fan, then HVAC fan operation is intermittent and either the fan type is ECM / ICM or the controls will reduce the controls per Footnote 5199.

7.7 Air inlet location (Complete if ventilation air inlet location was specified on design report; otherwise check "N/A"). 5244

8. Local Mechanical Exhaust - In each kitchen and bathroom, a system is installed that exhausts directly to the outdoors and meets one of the following Rater-measured airflow and manufacturer-rated sound level standards: 4948, 4447

<table>
<thead>
<tr>
<th>Location</th>
<th>Continuous Rate</th>
<th>Intermittent Rate 5004</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.1 Kitchen Airflow</td>
<td>≥ 5 ACH, based on kitchen volume 5054, 5150</td>
<td>≥ 100 CFM and, if not integrated with range, also ≥ 5 ACH based on kitchen volume 5054, 5150</td>
</tr>
<tr>
<td>Sound</td>
<td>Recommended: ≤ 1 sone</td>
<td>Recommended: ≤ 3 sones</td>
</tr>
<tr>
<td>8.2 Bathroom Airflow</td>
<td>≥ 20 CFM</td>
<td>≥ 50 CFM</td>
</tr>
<tr>
<td>Sound</td>
<td>Required: ≤ 1 sone</td>
<td>Recommended: ≤ 3 sones</td>
</tr>
</tbody>
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9. Filtration

9.1 MERV 6+ filter(s) installed in each ducted mech. system, designed so all return and mechanically supplied outdoor air passes through filter(s) prior to conditioning, and located to facilitate occupant access & regular service. 5344

9.3 All return and mechanically supplied outdoor air passes through filter prior to conditioning. 5334, 5344, 5347

10. Combustion Appliances

10.2 Fireplaces are mechanically drafted or direct-vented. Alternatives in Footnote 6662, 5944, 6667
<table>
<thead>
<tr>
<th>Rater Name: __________________________</th>
<th>Rater Pre-Drywall Inspection Date: __________</th>
<th>Rater Initials: ________</th>
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<tr>
<td>Rater Name: __________________________</td>
<td>Rater Final Inspection Date: __________</td>
<td>Rater Initials: ________</td>
</tr>
<tr>
<td>Builder Employee: _____________________</td>
<td>Builder Inspection Date: __________</td>
<td>Builder Initials: ________</td>
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</table>
15. Consistent with the 2009 IECC, slab edge insulation is only required for slab-on-grade floors with a floor surface less than 12 inches below grade. Slab insulation shall extend to the top of the slab to provide a complete thermal 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. Alternatively, the thermal break is permitted to be created using ≥ R-3 rigid insulation on top of an existing slab (e.g., in a home undergoing a gut rehabilitation). In such cases, up to 10% of the slab surface is permitted to not be insulated (e.g., for sleepers, for sill plates). Insulation installed on top of slab shall be covered by a durable floor surface (e.g., hardwood, tile, carpet).

16. 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. Where specific details cannot meet this requirement, partners shall provide the detail to EPA to request an exemption prior to the home’s certification. EPA will compile exempted details and work with industry to develop feasible details for use in future revisions to the program. A list of currently exempted details is available at: energystar.gov/slabedge.
32. Track A – HVAC Grading shall not be used until an implementation schedule has been defined for ANSI / RESNET / ACCA / ICC Std. 310 by
31. This Checklist is designed to meet the requirements of ASHRAE 62.2-2010 or later/ 2013 / 2016, and ANSI / ACCA's 5 QI-2015 protocol,
27. Existing sill plates (e.g., in a home undergoing a gut rehabilitation) on the interior side of structural masonry or monolithic walls are exempt from
26. In Climate Zones 6 - 8, a minimum stud spacing of 16 in. o.c.
23. All advanced framing details shall be met except where the builder, architect, or engineer provides a framing plan that encompasses the details
22. All advanced framing details shall be met except where the builder, architect, or engineer provides a framing plan that encompasses the details
21. Double-wall framing is defined as any framing method that ensures a continuous layer of insulation covering the studs to at least the R-value
20. Steel framing shall meet the reduced thermal bridging requirements by complying with Item 3.4.1 of the Checklist.
19. If used, insulated siding shall be attached directly over a water-resistant barrier and sheathing. In addition, it shall provide the required R-value
18. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentional
designed details (e.g., architectural details such as thermal fins, wing walls, or masonry fireplaces; structural details, such as steel columns). It shall be apparent to the Rater that the exempted areas are intentional designed details or the exempted area shall be documented in a plan provided by the builder, architect, or engineer. The Rater need not evaluate the necessity of the designed detail to certify the home.
17. Mass walls utilized as the thermal mass component of a passive solar design (e.g., a Trombe wall) are exempt from this Item. To be eligible for
this exemption, the passive solar design shall be comprised of the following five components: an aperture or collector, an absorber, thermal
mass, a distribution system, and a control system. For more information, see:
Mass walls that are not part of a passive solar design (e.g., CMU block or log home enclosure) shall either utilize the strategies outlined in Item
3.4 or the pathway in the assembly with the least thermal resistance, as determined using a method consistent with the 2013 ASHRAE Handbook
of Fundamentals, shall provide ≥ 50% of the applicable assembly resistance, defined as the reciprocal of the mass wall equivalent U-factor in the
2009 IECC Table 402.1.3. Documentation identifying the pathway with the least thermal resistance and its resistance value shall be collected by
the Rater and any Builder Verified or Rater Verified box under Item 3.4 shall be checked.
16. Up to 10% of the total exterior wall surface area is exempted from the reduced thermal bridging requirements to accommodate intentional
features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, (e.g., those caused by a lack of maintenance by
15. The use of rigid insulation in exterior walls shall be permitted only in Climate Zones 6 - 8. The minimum R-value that shall be required in the exterior
wall shall be as follows:
• between exterior wall sheathing and the interior framing member headers with insulation either in between or on one side, or an equivalent assembly. R-value requirement refers to manufacturer’s nominal insulation value.
14. Insulation shall be installed in the interior interior wall cavities to achieve or exceed the R-value in Item 3.4. Insulation shall be installed in the interior
13. In Climate Zones 6 - 8, a minimum stud spacing of 16 in. o.c. is permitted to be used with 2x6 framing if ≥ R-20.0 wall cavity insulation is achieved. However, all 2x6 framing with stud spacing of 16 in. o.c. in Climate Zones 6 - 8 shall have ≥ R-20.0 wall cavity insulation installed regardless of any framing plan or alternative equivalent total UA calculation.
12. Existing sill plates (e.g., in a home undergoing a gut rehabilitation) on the interior side of structural masonry or monolithic walls are exempt from
this Item. In addition, other existing sill plates resting atop concrete or masonry and adjacent to conditioned space are permitted, in lieu of using
a gasket, to be sealed with caulk, foam, or equivalent material at both the interior seam between the sill plate and the subfloor and the seam
between the top of the sill plate and the sheathing.
11. In Climate Zones 1 through 3, a continuous stucco cladding system adjacent to sill and bottom plates is permitted to be used in lieu of sealing
plates to foundation or sub-floor with caulk, foam, or equivalent material.
10. In Climate Zones 1 through 3, a continuous stucco cladding system sealed to windows and doors is permitted to be used in lieu of sealing rough
openings with caulk or foam.
9. Examples of durable covers include, but are not limited to, pre-fabricated covers with integral insulation, rigid foam adhered to cover with
adhesive, or biff insulation mechanically fastened to the cover (e.g., using bolts, metal wire, or metal strapping).
8. This Checklist is designed to meet the requirements of ASHRAE 62.2-2010 or later/ 2013 / 2016, and ANSI / ACCA’s 5 QI-2015 protocol,
thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these
features alone cannot prevent all ventilation, indoor air quality, and HVAC problems, (e.g., those caused by a lack of maintenance by
occupants). Therefore, this Checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.
7. For Track A, the Items in Section 5a are applicable to all unitary HVAC Systems including air conditioners and heat pumps up to 65 kBtuh and
furnaces up to 125 kBtuh. All applicable systems shall comply with 5a.1 through 5a.3 for the home to be certified.
6. For Track B, the Items in Section 5b are applicable to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source
(i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air
distribution systems (i.e., ducts). All applicable systems shall comply with 5b.1 and 5b.2 for the home to be certified.
5. If, based on the selected Track, the Items in Section 5 are not applicable to any systems in the home, the Rater shall mark ‘N/A’.
4. In Climate Zones 5 - 10, a minimum stud spacing of 16 in. o.c. is permitted to be used with 1x6 framing if ≥ R-11.0 wall cavity insulation is achieved. However, all 2x4 framing with stud spacing of 16 in. o.c. in Climate Zones 5 - 10 shall have ≥ R-11.0 wall cavity insulation installed regardless of any framing plan or alternative equivalent total UA calculation.
3. R-value, distribution systems (i.e., ducts). All applicable systems shall comply with 5a.1 through 5a.3 for the home to be certified.
2. Track A – HVAC Grading shall then use ANSI / RESNET / ACCA / ICC Std. 310 by
the HCO that the home is being certified under . Track A – HVAC Grading shall then use ANSI / RESNET / ACCA / ICC Std. 310 including all
Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO that the
home is being certified under.
1. For Track A, the Items in Section 5a are applicable to all unitary HVAC Systems including air conditioners and heat pumps up to 65 kBtuh and
furnaces up to 125 kBtuh. All applicable systems shall comply with 5a.1 through 5a.3 for the home to be certified.

For Track B, the Items in Section 5b are applicable to split air conditioners, unitary air conditioners, air-source heat pumps, and water-source
(i.e., geothermal) heat pumps up to 65 kBtuh with forced-air distribution systems (i.e., ducts) and to furnaces up to 225 kBtuh with forced-air
distribution systems (i.e., ducts). All applicable systems shall comply with 5b.1 and 5b.2 for the home to be certified.

If, based on the selected Track, the Items in Section 5 are not applicable to any systems in the home, the Rater shall mark ‘N/A’.
48.50. For example, if an outdoor air inlet connected to a ducted return is used as a dedicated source of outdoor air for an exhaust ventilation system (e.g., bath fan), the outdoor airflow must be automatically restricted when the exhaust fan is not running and in the event of an override of the exhaust ventilation system.
49.51 When assessing the ventilation rate, the highest HVAC fan speed applicable to ventilation mode shall be used (e.g., if the inlet only opens
when the HVAC is in ‘fan-only’ mode, then test in this mode). If the inlet has a motorized damper that only opens when the local mechanical
kitchen exhaust is turned on, then testing is not required.

When required, the ventilation airflow through the inlet shall be measured and documented by a Rater using ANSI / RESNET / ICC Std 380
including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO
that the home is being certified under. As an alternative, measurement of the outdoor airflow can be waived if a Constant Airflow Regulating (CAR) damper with a manufacturer-specified maximum flow rate no higher than 15 CFM or 15% above the ventilation design value is installed on the inlet.

50.52 Dwelling Unit Mechanical Ventilation System fans shall be rated for sound at no less than the airflow rate in Item 2.3 of the National HVAC
Design Report. Fans exempted from this requirement include HVAC air handler fans, remote-mounted fans, and intermittent fans rated ≥ 400
CFM. To be considered for this exemption, a remote-mounted fan must be mounted outside the habitable spaces, bathrooms, toilets, and
hallways and there shall be ≥ 4 ft. ductwork between the fan and intake grill. Per ASHRAE 62.2-2010, habitable spaces are intended for continual
human occupancy; such space generally includes areas used for living, sleeping, dining, and cooking but does not generally include bathrooms,
Toilets, hallways, storage areas, closets, or utility rooms.

51.53 Note that the ‘fan-on’ setting of a thermostat would not be an acceptable controller because it would continuously operate the HVAC fan.

52.54 Bathroom fans with a rated flow rate ≥ 500 CFM are exempted from the requirement to be ENERGY STAR certified.

53.55 Ventilation air inlets that are only visible via rooftop access are exempted from Item 7.7 and the Rater shall mark “N/A”. The outlet and inlet
of balanced ventilation systems shall meet these spacing requirements unless manufacturer instructions indicate that a smaller distance may be
used. However, if this occurs the manufacturer’s instructions shall be collected for documentation purposes.

54.56 Without proper maintenance, ventilation air inlet screens often become filled with debris. Therefore, EPA recommends, but does not require,
that these ventilation air inlets be located so as to facilitate access and regular service by the occupant.

55.57 Known contamination sources include, but are not limited to, stacks, vents, exhausts, and vehicles.

56.58 Continuous bathroom local mechanical exhaust fans shall be rated for sound at no less than the airflow rate in Item 8.2. Intermittent
bathroom and both intermittent and continuous kitchen local mechanical exhaust fans are recommended, but not required, to be rated for sound
at no less than the airflow rate in Items 8.1 and 8.2. Per ASHRAE 62.2-2010, an exhaust system is one or more fans that remove air from the
building, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope (e.g., bath exhaust fans, range
hoods, clothes dryers). Per ASHRAE 62.2-2010, a bathroom is any room containing a bathtub, shower, spa, or similar source of moisture.

57.59 An intermittent mechanical exhaust system, where provided, shall be designed to operate as needed by the occupant. Control devices shall
not impede occupant control in intermittent systems.

58.60 Kitchen volume shall be determined by drawing the smallest possible rectangle on the floor plan that encompasses all cabinets, pantries,
islands, peninsulas, ranges / ovens, and the kitchen exhaust fan, and multiplying by the average ceiling height for this area. In addition, the
continuous kitchen exhaust rate shall be ≥ 25 CFM, per 2009 IRC Table M1507.3, regardless of the rate calculated using the kitchen volume.
Cabinet volume shall be included in the kitchen volume.

59.61 Homes shall meet this item. Alternatively, the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 or later/2013/2016
are permitted to be used for kitchen exhaust fans based upon the rated airflow of the fan at 0.25 IWC. If the rated airflow is unknown, ≥ 6 in.
smooth duct shall be used, with a round duct transition as needed. Guidance to assist partners with these alternatives is available at
http://www.energystar.gov/newhomesguidance. As an alternative to Item 8.1, homes are permitted to use a continuous kitchen exhaust rate
of 25 CFM per 2009 IRC Table M1507.3, if they are either a) PhiUSPH+ or PHI certified, or b) provide both dwelling unit ventilation and local
mechanical kitchen exhaust using a balanced system, and have a Rater-verified whole-building infiltration rate ≤ 1.0 ACH50 or ≤ 0.05 CFM50
per sq. ft. of Enclosure Area, and a Rater-verified dwelling unit compartmentalization rate ≤ 0.30 CFM50 per sq. ft. of Enclosure Area if multiple
dwelling units are present in the building. ‘Enclosure Area’ is defined as the area of the surfaces that bound the volume being pressurized /
depressurized during the test.

60.62 All intermittent kitchen exhaust fans must be capable of exhausting at least 100 CFM. In addition, if the fan is not part of a vented range
hood or appliance-range hood combination (i.e., if the fan is not integrated with the range), then it must also be capable of exhausting ≥ 5 ACH,
based on the kitchen volume.

61.63 Based upon ASHRAE 62.2-2010, ducted mechanical systems are those that supply air to an occupiable space with a total amount of supply
ductwork exceeding 10 ft. in length and through a thermal conditioning component, except for evaporative coolers. Systems that do not meet
this definition are exempt from this requirement. While filters are recommended for mini-split systems, HRV’s and ERV’s, these systems, ducted
or not, typically do not have MERV-rated filters available for use and are, therefore, also exempted under this version of the requirements. EPA
also recommends, but does not require, filtering air inlets to minimize outdoor particles entering the home. HVAC filters located in the attic shall
be considered accessible to the occupant if either 1) drop-down stairs, a pull-down ladder, or door provide access to attic and a permanently
installed walkway has been provided between the attic access location and the filter or 2) the filter location enables arm-length access from a
portable ladder without the need to step into the attic and the height of the ceiling access panel or the bottom of the wall access panel where
access is provided is ≤ 12 ft.

62.64 Sealing mechanisms comparable to a gasket are also permitted to be used. The filter media box (i.e., the component in the HVAC system
that houses the filter) may be either site-fabricated by the installer or pre-fabricated by the manufacturer to meet this requirement. These
requirements only apply when the filter is installed in a filter media box located in the HVAC system, not when the filter is installed flush with the
return grill.

63.65 The pressure boundary is the primary enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage
to outside than to conditioned space would be outside the pressure boundary.

64.66 Per the 2009 International Mechanical Code, a direct-vent appliance is one that is constructed and installed so that all air for combustion is
derived from the outdoor atmosphere and all flue gases are discharged to the outside atmosphere; a mechanical draft system is a venting system
designed to remove flue or vent gases by mechanical means consisting of an induced draft portion under non-positive static pressure or a forced
draft portion under positive static pressure; and a natural draft system is a venting system designed to remove flue or vent gases under nonpositive static vent pressure entirely by natural draft.

65.67. This item only applies to furnaces, boilers, and water heaters located within the home’s pressure boundary. Naturally drafted equipment is allowed within the home’s pressure boundary in Climate Zones 1-3 if the Rater has followed ANSI / ACCA 12 QH-2014, Section 3.2.2, Appendix A Sections A2.2.6, A3 (Carbon Monoxide Test), A4 (Depressurization Test for the Combustion Appliance Zone), and verified that the equipment meets the limits defined within.

66.68. This item only applies to fireplaces located within the home’s pressure boundary. Naturally drafted fireplaces are allowed within the home’s pressure boundary if the Rater has verified that the total net rated exhaust flow of the two largest exhaust fans (excluding summer cooling fans) is \( \leq 15 \text{ CFM per 100 sq. ft. of occupiable space when at full capacity.} \) If the net exhaust flow exceeds the allowable limit, it shall be reduced or compensating outdoor airflow provided. Per ASHRAE 62.2-2010, the term “net rated exhaust flow” is defined as flow through an exhaust fan minus the compensating outdoor airflow through any supply fan that is interlocked to the exhaust fan. Per ASHRAE 62.2-2010, the term “occupiable space” is defined as any enclosed space inside the pressure boundary and intended for human activities, including, but not limited to, all habitable spaces, toilets, closets, halls, storage and utility areas, and laundry areas. See Footnote 525254 for the definition of “habitable spaces”.

69. The minimum volume of combustion air required for safe operation by the manufacturer and / or code shall be met or exceeded. Also, in accordance with the National Fuel Gas Code, ANSI Z223.1 / NFPA54, unvented room heaters shall not be installed in bathrooms or bedrooms.

67.70. Alternatively, unvented combustion appliances other than cooking ranges or ovens are permitted to be located inside the home’s pressure boundary if the Rater has followed ANSI/ACCA 12 QH-2014, Section 3.2.2, Appendix A Sections A2.2.6, A3, and A4, and verified the equipment meets the limits defined within.