EPA United States Environmental Protection Agency

VERSION 1 (REV. 01)

Indoor airPLUS
CONSTRUCTION SPECIFICATIONS

EPA Indoor airPLUS QUALIFIED HOME

ENERGY STAR

Contents

About the Indoor airPLUS Construction Specifications

These specifications were developed by the U.S. Environmental Protection Agency (EPA) to recognize new homes equipped with a comprehensive set of indoor air quality (IAQ) features. They were developed with significant input from stakeholders, based on best available science and information about risks associated with IAQ problems, and balanced with practical issues of cost, builder production process compatibility, and verifiability.

NOTE: Although these measures are designed to help improve IAQ in new homes compared with homes built to minimum code, they alone cannot prevent all IAQ problems. For example, occupant behavior, such as smoking indoors, and system maintenance are also important.

What's New in Version 1 (Rev. 01)?

Indoor airPLUS V1 (Rev. 01) contains the first revisions to the original Indoor airPLUS Construction Specifications issued in 2009. This revision is designed to:

- Improve the alignment of the Indoor airPLUS and ENERGY STAR for Homes requirements and provide a revised layout that clearly outlines the Indoor airPLUS requirements that are now satisfied by completion of the ENERGY STAR checklists and the additional Indoor airPLUS (Rev. 01) requirements that must be met to achieve Indoor airPLUS certification.
- Provide a clearer, simpler version of the Verification Checklist.
- Provide alternate pathways to meet program requirements that address the wide variety of construction materials and techniques currently available.

Eligibility and Verification Requirements

For a home to earn the Indoor airPLUS label, it must also earn the ENERGY STAR Version 3 label for Certified Homes. Requirements for both programs can be verified and homes can be reported simultaneously. Verification can be completed during the ENERGY STAR inspection process and must be conducted by a Provider accredited by the Residential Energy Services Network (RESNET) in accordance with RESNET standards and all applicable codes. Instructions for Indoor airPLUS verification are listed below in the Verification Checklist.

Qualified homes earn the Indoor airPLUS label. Place it next to the ENERGY STAR label.

Terms Used in This Document

- **EXCEPTIONS** to the requirements described in these construction specifications are noted as appropriate. For climate exceptions, refer to the 2009 International Energy Conservation Code (IECC) Climate Zone map (Figure 301.1). Climate Zone names may include a number for the temperature zone and a letter for the moisture zone (e.g., Zone 3C refers to coastal California only).
- **NOTES** provide additional information to clarify specification requirements.
- **ADVISORIES** provide additional guidance to be considered, but are not specification requirements.
- **PERFORMANCE TEST ALTERNATIVES** describe alternate compliance approaches where performance testing is practical and results are comparable to those of the prescriptive best practices required in the specification.

Indoor airPLUS Version 1 (Rev. 01) Verification Checklist

EPA
United States
Environmental Protection
Agency

EPA Indoor airPLUS QUALIFIED HOME

Home Address:		City:		State:		Zip:	

Section	Requirements (Refer to full Indoor airPLUS Construction Specifications for details)	Must Correct	Builder Verified	Rater Verified	N/A
	Note: The Rev. 01 checklist has been modified to reflect only the additional Indoor airPLUS requirements and their corresponding section numbers that must be met after completing the ENERGY STAR checklists. ENERGY STAR remains a prerequisite for Indoor airPLUS certification.				
ENERGY STAR V3 Checklists	Thermal Enclosure System Rater Checklist completed.	☐		☐	
	Water Management System Builder Checklist completed.	☐		☐	
	HVAC System Quality Installation Contractor Checklist completed.	☐		☐	
	HVAC System Quality Installation Rater Checklist completed.	☐		☐	
Moisture Control	1.1 Drain or sump pump installed in basements and crawlspaces (Exception: free-draining soils). In EPA Radon Zone 1, check valve also installed.	☐	☐	☐	☐
	1.2 Layer of aggregate or sand (4 in.) with geotextile matting installed below slabs AND radon techniques used in EPA Radon Zone 1.	☐	☐	☐	☐
	1.4 Basements/crawlspaces insulated, sealed and conditioned (Exceptions: see spec).	☐	☐	☐	☐
	1.7 Protection from water splash damage if no gutters (Exceptions: see spec).	☐		☐	☐
	1.11 Hard-surface flooring in kitchens, baths, entry, laundry and utility rooms, AND piping in exterior walls insulated with pipe wrap.	☐		☐	
Radon	2.1 Approved radon-resistant features installed in Radon Zone 1 homes.	☐	☐	☐	☐
Pests	3.2 Corrosion-proof rodent/bird screens installed at all openings that cannot be fully sealed (Exception: dryer vents).	☐	☐	☐	
HVAC Systems	4.1 Equipment selected to keep relative humidity < 60% in "Warm-Humid" climates (Exception: see spec).	☐		☐	☐
	4.2 Duct systems protected from construction debris AND no building cavities used as air supplies or returns.	☐	☐	☐	
	4.3 No air-handling equipment or ductwork installed in garage AND continuous air barrier in adjacent assemblies.	☐		☐	
	4.7 Central forced-air HVAC system(s) have minimum MERV 8 filter AND no ozone generators in home.	☐	☐	☐	
Combustion Pollutants	5.1 Emissions standards met for fuel-burning and space-heating appliances (Exception: see spec).	☐		☐	☐
	5.2 CO alarms installed in each sleeping zone (e.g., common hallway) according to NFPA 720.	☐		☐	☐
	5.3 Multifamily buildings: Smoking restrictions implemented AND ETS transfer pathways minimized.	☐	☐	☐	☐
	5.4 Attached garages: Door closer installed on all connecting doors AND 70 cfm exhaust fan installed in garage.	☐		☐	☐
Materials	6.1 Certified low-formaldehyde composite wood materials AND structural plywood AND OSB PS1 or PS2 compliant.	☐	☐	☐	
	6.2 Certified low-VOC or no-VOC interior paints and finishes used.	☐	☐	☐	
	6.3 Carpet, carpet adhesives CRI Green Label Plus AND carpet cushion CRI Green Label.	☐	☐	☐	☐
Final	7.1 HVAC system and ductwork verified to be dry and clean AND new filter installed.	☐	☐	☐	
	7.2 Home ventilated before occupancy.	☐	☐	☐	☐
	7.3 Completed checklist and other required documentation provided for buyer.	☐	☐	☐	☐

Rater Name:	Rater Pre-Drywall Inspection Date:	Rater Initials:
Rater Name:	Rater Final Inspection Date:	Rater Initials:
Builder Employee:	Builder Inspection Date:	Builder Initials:

Guidance for Completing the Indoor airPLUS Verification Checklist:

1. Only ENERGY STAR certified homes verified to comply with these specifications can earn the Indoor airPLUS label. See Indoor airPLUS Construction Specifications for full descriptions of the requirements, terms, exceptions, abbreviations, references and climate map used in this checklist. Verification is not complete until this checklist is completed in full and signed.

2. Check one box per line. Check "N/A" for specifications that do not apply for specific conditions (e.g., climate) according to the exceptions described in the Indoor airPLUS Construction Specifications. Check either "Builder Verified" or "Rater Verified" for all other items to indicate who verified each item. Items may be verified visually on site during construction, by reviewing photographs taken during construction, by checking documentation, or through equivalent methods as appropriate.

3. The Rater who conducted the verification, or a responsible party from the Rater's company, must sign the completed verification checklist. The builder must sign the checklist if any items in the "Builder Verified" column are checked, and by so doing accepts full responsibility for verifying that those items meet Indoor airPLUS requirements.

4. The builder provides one copy of the completed and signed Indoor airPLUS Verification Checklist for the buyer. The HERS Provider or Rater files a copy of the HERS and ENERGY STAR documentation (e.g., ENERGY STAR Qualified Homes Version 3 Inspection Checklists) for the home.

5. Raters who operate under a Sampling Provider are permitted to use a RESNET-approved sampling protocol for Indoor airPLUS homes located outside California, and a sampling protocol approved by the California Energy Commission for homes located in California, to verify any item designated "Rater Verified." For example, if the approved sampling protocol requires rating one in seven homes, then the checklist will be completed for the one home that was rated. Only Raters are permitted to use sampling. All items verified by the builder shall be verified for each qualified home. For example, if a Rater verifies 10 items on the Indoor airPLUS Checklist and the builder verifies the remaining checklist items, then an approved sampling protocol is permitted to be used only on the 10 Rater-verified items.

Notes:

For further information on the Indoor airPLUS program, visit epa.gov/indoorairplus.

Qualified homes earn the Indoor airPLUS label. Place it next to the ENERGY STAR label.

All Indoor airPLUS qualified homes meet strict guidelines for energy efficiency set by ENERGY STAR, the nationally-recognized symbol for energy efficiency.

Indoor airPLUS Construction Specifications
Version 1 (Rev. 01)

All ENERGY STAR for Homes Version 3 checklists must be successfully completed and reported to achieve Indoor airPLUS certification. ENERGY STAR checklist items that satisfy Indoor airPLUS requirements are only summarized below; please refer to the noted ENERGY STAR checklist item for the full description of the requirement.

ENERGY STAR checklists are referenced as follows: TES =Thermal Enclosure System Rater Checklist, HVAC-C = HVAC System Quality Installation Contractor Checklist, HVAC-R = HVAC System Quality Installation Rater Checklist, WMS = Water Management System Builder Checklist.

1. Moisture Control

1.1 Site and Foundation Drainage

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Slope patio slabs, walks and driveway; tamp back-fill to prevent settling; AND slope the final grade away from the foundation (WMS 1.1 and 1.2).*

- *Swales or drains designed to carry water away from the foundation are permitted to be provided as an alternative to the slope requirements for any home, and shall be provided for a home where setbacks limit space to less than 10 ft. (WMS 1.1and 1.2).*

- *Install protected drain tile at the footings of basement and crawlspace walls. Surround each drain tile pipe with washed or clean gravel wrapped with fabric cloth, or install an approved Composite Foundation Drainage System (CFDS) (WMS 1.8).*

Additional Indoor airPLUS Requirements:

- Install a drain or sump pump in basement and crawlspace floors, discharging to daylight at least 10 ft. outside the foundation or into an approved sewer system.

- **Exceptions:**

  ○ Slab-on-grade foundations.

  ○ In areas of free-draining soils — identified as Group 1 (Table R405.1, 2009 IRC) by a certified hydrologist, soil scientist, or engineer through a site visit — installation of a drain or sump pump is not required.

- In EPA Radon Zone 1, if a drain tile discharges to daylight install a check valve at the drain tile outfall (see Specification 2.1).

1.2 Capillary Break Installation

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Install polyethylene sheeting or extruded polystyrene (XPS) insulation beneath concrete slabs, including basement floors. Ensure sheeting is in direct contact with the concrete slab above (WMS 1.3).*

- *Install a capillary break at all crawlspace floors using ≥ 6 mil polyethylene sheeting, lapped 6 to 12 in. (WMS 1.4).*

Additional Indoor airPLUS Requirements:

- Under the polyethylene sheeting or extruded polystyrene (XPS) insulation installed to meet ENERGY STAR Water Management System Builder Checklist Item 1.3:

  ○ Install a 4 in. layer of 1/2 in. diameter or greater clean aggregate; OR

  ○ Install a 4 in. uniform layer of sand, overlain with either a layer of geotextile drainage matting throughout or strips of geotextile drainage matting along the perimeter installed according to the manufacturer's instructions.

  ○ **Exception:** Dry climates, as defined by 2009 IECC Figure 301.1, not including EPA Radon Zone 1.

- **Note:** In EPA Radon Zone 1 (see Specification 2.1):

  ○ Overlap polyethylene sheeting by 6 to 12 in. at the seams.

  ○ Do not use extruded polystyrene (XPS) insulation beneath concrete slabs, including basement floors.

  ○ ENERGY STAR staking method for crawlspaces with no slab is not allowed.

- **Note:** 10 mil polyethylene is recommended if crawlspace floors are not covered with a concrete slab.

1.3 Damp-Proofing and Waterproofing Below-Grade Exterior Walls

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Finish all masonry and concrete walls (e.g., poured concrete, concrete masonry, insulated concrete forms) with a damp-proof coating (WMS 1.5).*

- *Finish all wood-framed walls with polyethylene and adhesive or other equivalent waterproofing (WMS 1.5).*

No additional Indoor airPLUS Requirements

1.4 Basement and Crawlspace Insulation and Conditioned Air

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

• All floors above unconditioned spaces shall be insulated to the 2009 IECC and sealed to prevent air infiltration (TES 2 and 3).

Additional Indoor airPLUS Requirements:

• Insulate crawlspace and basement perimeter walls according to 2009 IRC Table N1102.1 or 2009 IECC Table 402.1.1 (also see Specification 1.12).

• Seal crawlspace and basement perimeter walls to prevent outside air infiltration.

• Provide conditioned air at a rate not less than 1 cfm per 50 sq. ft. of horizontal floor area. If radon-resistant features are required (see Specification 2.1), do not install exhaust ventilation, as described in 2009 IRC section R408.3.2.1.

• **Exceptions:**

○ Homes built in areas designated as flood zones (conditioned crawlspaces not recommended for use in flood zones).

○ Raised pier foundations with no walls.

○ Dry climates, as defined by 2009 IECC Figure 301.1.

○ Marine climates, as defined by 2009 IECC Figure 301.1, if no air handler or return ducts are installed in the crawlspace.

1.5 Drainage Plane and Drainage System

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

• Install a continuous drainage plane behind exterior wall cladding that overlaps flashing and is fully sealed at all penetrations (WMS 2.2).

• Install flashing or an equivalent drainage system at the bottom of exterior walls to direct water away from the drainage plane and foundation (WMS 2.1).

No additional Indoor airPLUS Requirements

1.6 Window and Door Openings

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

• Fully flash all window and door openings, including pan flashing over the rough sill framing, side flashing that extends over pan flashing and top flashing that extends over side flashing (WMS 2.3).

No additional Indoor airPLUS Requirements

1.7 Gutters, Downspouts and Site Drainage

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

• Direct roof water away from the house using gutters and downspouts that empty into lateral piping on a sloping finish grade (WMS 3.2); OR

• Direct roof water to an underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation (WMS 3.2).

Additional Indoor airPLUS Requirements

• Provide extra protection for water splash damage on homes meeting one of the following ENERGY STAR exceptions for gutters and downspouts: slab on grade homes, homes that deposit rainwater to a grade-level rock bed with a waterproof liner and drain pipe, or homes that use a continuous rubber membrane system. Protection for water splash damage shall be met by one of the following:

○ Extend the foundation walls at least 16 in. above final grade; OR

○ Provide a drip line that is horizontally 16 in. away from the edge of the foundation wall; OR

○ Use cladding material that can tolerate regular wetting and install a well-sealed, continuous drainage plane that extends at least 16 in. above final grade (e.g. brick veneer, stone cladding with self-adhering moisture control membrane).

• **Exceptions:**

○ Dry climates, as defined by 2009 IECC Figure 301.1.

○ Homes with rainwater harvesting systems that are designed to properly drain overflow, meeting discharge-distance requirements outlined in ENERGY STAR WMS Item number 3.2.

1.8 Roof to Wall Intersections and Roof Penetrations

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

• Fully flash all roof-to-wall intersections and all roof penetrations using step flashing for conventional roofs or continuous flashing for metal and rubber membrane roofs (WMS 3.1).

• Install "kick-out" flashing at the low end of roof-to-wall intersections (WMS 3.1).

No additional Indoor airPLUS Requirements

1.9 Roof Valleys and Decking

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Install a self-sealing bituminous membrane or the equivalent at all valleys and roof decking penetrations for durability at potential failure points (WMS 3.3).*

No additional Indoor airPLUS Requirements

1.10 Roof Eaves

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Install ice flashing over the sheathing at eaves to provide protection from ice dams (WMS 3.4).*

- *Extend a self-sealing bituminous membrane or the equivalent ("ice flashing") from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall (WMS 3.4).*

No additional Indoor airPLUS Requirements

1.11 Moisture-Resistant Materials and Moisture-Protective Systems

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Install moisture-resistant backing material behind tub and shower enclosures (WMS 4.2).*

- *Install a corrosion-resistant drain pan properly draining to a conspicuous point of disposal (HVAC-R 12.1).*

Additional Indoor airPLUS Requirements:

- Install only water-resistant hard-surface flooring in kitchens, bathrooms, entryways, laundry areas and utility rooms.

- Insulate water supply pipes in exterior walls with pipe wrap.

1.12 Class 1 Vapor Retarders

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Do not install Class 1 vapor retarders on the interior side of vapor permeable insulation in below-grade exterior walls or in any exterior walls in Warm-Humid climates (WMS 1.6 and 4.3).*

No additional Indoor airPLUS Requirements

1.13 Materials with Signs of Water Damage or Mold

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Building materials with visible signs of water damage or mold not installed or allowed to remain. If mold is present, effort should be made to remove all visible signs of mold (e.g., by damp wipe with water and detergent). If removal methods are not effective, then the material shall be replaced. However,*

stains that remain after damp wipe are acceptable. Lumber with "sap stain fungi" is exempt from this Item as long the lumber is structurally intact. (WMS 4.4).

- *Do not enclose (e.g., with drywall) framing members and insulation products having high moisture content. (Note: Lumber should not exceed 18 percent moisture) (WMS 4.5).*

- *For wet-applied insulation, follow the manufacturer's drying recommendations (WMS 4.5).*

No additional Indoor airPLUS Requirements:

2. Radon

2.1 Radon-Resistant Construction

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Air seal all sump covers (WMS 1.7).*

Additional Indoor airPLUS Requirements:

- Construct homes in EPA Radon Zone 1 (see www.epa. gov/radon/zonemap.html) with radon-resistant features to conform to ASTM E1465; or IRC, Appendix F; or NFPA 5000, Chapter 49. Consult EPA's "Building Radon Out" (EPA 402-K-01-002) for general guidance on installing radon-resistant features.

  Visually verify the following requirements:

  ○ Capillary break installed according to Specification 1.2.

  ○ A 3 or 4 in. diameter gas-tight vertical vent pipe, clearly labeled to conform with the radon-resistant standard used, e.g., "Radon Reduction System" or "Radon Pipe" or "Radon System." The vent pipe shall be connected to an open T-fitting in the aggregate layer (or connected to geotextile drainage matting according to the manufacturer's instructions) beneath the polyethylene sheeting, extending up through the conditioned spaces and terminating a minimum of 12 in. above the roof opening. For crawlspaces, install at least 5 ft. of horizontal perforated drain tile on either side of the T-fitting, attached to the vertical radon vent pipe beneath the sheeting and running parallel to the long dimension of the house.

  ○ Radon fan installed in the attic (i.e., an active system) OR an electrical receptacle installed in an accessible attic location near the radon vent pipe (i.e., a passive system) to facilitate future fan installation if needed.

  ○ Foundation air sealing with polyurethane caulk or the equivalent at all slab openings, penetrations and control or expansion joints.

- **Note:** Consult local building codes to determine whether additional radon requirements apply. In January 2013 ANSI-AARST published a standard of practice for "Reducing Radon in New Construction of 1&2 Family Dwellings and Townhouses (CCAH-2013)", available at http://www.aarst.org/bookstore.shtml.

- **Advisories:**

  1. Elevated levels of radon have been found in homes built in all three zones on EPA's Map of Radon Zones. Consult your state radon program for current information about radon in your area. Go to http://www.epa.gov/radon/whereyoulive.html and click on your state for contact information.

  2. EPA recommends, but does not require, that all homes built with radon-resistant features in EPA Radon Zone 1 pre-emptively include a radon vent fan. EPA also recommends, but does not require, radon-resistant features for homes built in EPA Radon Zones 2 and 3. EPA further recommends that all homes built in EPA Radon Zones 2 and 3 with radon-resistant features be tested for radon prior to occupancy. A radon vent fan should be installed when the test result is 4 pCi/L (the EPA action level) or more.

  3. The U.S. Surgeon General and EPA recommend that all homes built in Radon Zones 1, 2 and 3 be tested for radon. Provide buyers with EPA's Citizen's Guide to Radon, encourage them to test for radon and refer them to http://www.epa.gov/radon for more information.

  4. If soil or groundwater contamination is suspected on or near the building site (e.g., former industrial sites), volatile chemical contaminants from soil gas or vapor intrusion into a building may pose an IAQ risk. In such cases, EPA recommends radon-resistant features consistent with Specification 2.1, which can minimize or prevent the vapor intrusion into a house. See the EPA Vapor Intrusion Primer or ASTM E2600 for more information. You should also consult your state, tribal, or local environmental regulatory agency for information on the location of contaminated sites, including those subject to Superfund (CERCLA), Resource Conservation and Recovery Act (RCRA) cleanup requirements, or the Brownfields program. Visit EPA's "Where You Live" for more information.

3. Pest Barriers

3.1 Minimize Pathways for Pest Entry

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Seal all penetrations and joints between the foundation and exterior wall assemblies (TES 5).*

- *Air seal all sump covers (WMS 1.7).*

No additional Indoor airPLUS Requirements

- **Advisories:**

  1. When sealing larger gaps that provide potential points of entry for rodents, copper or stainless steel wool is recommended in addition to sealant.

  2. Additional precautions should be taken in areas classified as "Moderate to Heavy" termite infestation probability (as identified by 2009 IRC Figure 301.2 [6]):

     - Foundation walls should be solid concrete or masonry with a top course of solid block, bond beam, or concrete-filled block.

     - Interior concrete slabs should be constructed with 6 x 6 in. welded wire fabric, or the equivalent, and concrete walls should be constructed with reinforcing rods to reduce cracking.

     - Sill plates should be made of metal or preservative-treated wood.

  3. Additional precautions should be taken in areas classified as "Very Heavy" termite infestation probability (as identified by 2009 IRC Figure 301.2[6]) i.e., Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina and parts of California and Texas:

     - Foam plastic insulation should not be installed on the exterior face of below-grade foundation walls or under slabs.

     - Foam plastic insulation installed on the exterior of above-grade foundation walls should be kept a minimum of 6 in. above the final grade and any landscape bedding materials and should be covered with moisture-resistant, pest-proof material (e.g., fiber cement board or galvanized insect screen at the bottom-edge of openings).

     - Foam plastic insulation applied to the interior side of conditioned crawlspace walls should be kept a minimum of 3 in. below the sill plate.

3.2 Rodent/Bird Screens for Building Openings

Indoor airPLUS Requirements:

- Provide corrosion-proof rodent/bird screens (e.g., copper or stainless steel mesh) for all building openings that cannot be fully sealed and caulked (e.g., ventilation system intake/exhaust outlets and attic vent openings).

- **Exception:** This requirement does not apply to clothes dryer vents.

4. HVAC Systems

4.1 HVAC Sizing and Design

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Properly size all heating and cooling equipment to accommodate design loads for each room as determined using ACCA Manual J, ASHRAE Handbooks, or equivalent software, as well as the pressure drop from all specified filters (HVAC-C 2).*

Additional Indoor airPLUS Requirements:

- In "Warm-Humid" climates as defined by 2009 IECC Figure 301.1 (i.e., Climate Zone 1 and portions of Zones 2 and 3A below the white line), equipment shall be installed with sufficient latent capacity to maintain indoor relative humidity (RH) at or below 60 percent. This requirement shall be met by either:

  ○ Additional dehumidification system(s), OR

  ○ A central HVAC system equipped with additional controls to operate in dehumidification mode.

- **Exception:** Climate Zones 4-8, 3B, 3C and the portions of 3A and 2B above the white line as shown by 2009 IECC Figure 301.1.

- **Advisory:** Although not required to meet this specification, independent dehumidification is recommended in Climate Zones 4A and 3A above the white line as shown in 2009 IECC Figure 301.1.

4.2 Duct System Design and Installation

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Design all duct systems according to ACCA Manual D, ASHRAE Handbooks, or equivalent software (HVAC-C 2).*

- *Ensure that all duct systems are installed to be substantially airtight and properly balanced (HVAC-R 2 and 4).*

Additional Indoor airPLUS Requirements:

- Do not use building cavities as part of the forced air supply or return systems.

- Either cover duct openings throughout construction to protect from construction debris or vacuum out ducts thoroughly prior to installing registers, grilles and diffusers (see Specification 7.1).

- **Advisory:** Seams in the HVAC cabinet, plenum and adjacent ductwork shall be sealed with mastic systems, tape that meets the applicable requirements of UL 181a or UL 181b, or gasket systems.

4.3 Location of Air-Handling Equipment and Ductwork

Indoor airPLUS Requirement:

- Do not locate air-handling equipment or ductwork in garages.

- **Note:** Ducts and equipment may be located in framing spaces or building cavities adjacent to garage walls or ceilings if they are separated from the garage space with a continuous air barrier (see ENERGY STAR Thermal Enclosure System Rater Checklist).

4.4 Room Pressure Differentials

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Minimize room pressure differentials for any bedroom (as defined by RESNET standards) that does not have a dedicated return (HVAC-R 2.8).*

No additional Indoor airPLUS Requirements

4.5 Mechanical Whole-House Ventilation

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Provide mechanical whole-house ventilation meeting all requirements of ASHRAE 62.2-2010 (HVAC-C 1).*

- *Test airflows to ensure they meet ASHRAE 62.2-2010 minimum requirements (HVAC-R 5.1).*

- *Visually verify the following requirements:*

  ○ *Transfer air is not used to meet ventilation requirements (HVAC-R 7.4).*

  ○ *Outdoor air inlets are located a minimum of 10 ft. from contaminant sources (HVAC-R 7.1).*

- **Advisory:** Outdoor air ducts connected to the return side of an air handler should be used as supply ventilation only if the manufacturers' requirements for return air temperature are met (e.g., most manufacturers recommend a minimum of 60 degrees Fahrenheit air flow across furnace heat exchangers).

4.6 Local Exhaust for Known Pollutant Sources

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirements:

- *Provide local mechanical exhaust ventilation to the outdoors in each bathroom and kitchen, meeting ASHRAE 62.2-2010 Section 5 requirements (HVAC-R 8.1 and 8.2).*

- *Vent all conventional clothes dryers directly to the outdoors (HVAC-R 8.5).*

No additional Indoor airPLUS Requirements

4.7 Filtration for Central Forced-Air HVAC Systems

NOTE: Completion of the [ENERGY STAR checklists](#) now satisfies the following Indoor airPLUS requirement:

- *Equip all filter access panels with gasket material or comparable sealing mechanism and ensure access panels fit snugly against the exposed edge of the installed filter when closed to prevent bypass (HVAC-R 11.4).*

Additional Indoor airPLUS Requirements:

- Install only HVAC filters that are rated MERV 8 or higher according to ASHRAE 52.2-2007 (at approximately 295 fpm).

  - **Advisory:** Filters perform best when the filter rack design includes the following features, which are also included in some manufacturers' filter media boxes:

    - Flexible, air-tight (e.g., closed-cell foam) gasket material on the surface that contacts the air-leaving (downstream) side of the filter.

    - Friction fit or spring clips installed on the upstream side of the filter to hold it firmly in place.

- Do not install any air-cleaning equipment designed to produce ozone (i.e., ozone generators).

5. Combustion Pollutant Control

5.1 Combustion Equipment Located in Conditioned Spaces

NOTE: Completion of the [ENERGY STAR checklists](#) now satisfies the following Indoor airPLUS requirements:

- *Mechanically draft or direct vent all gas- and oil-fired furnaces, boilers and water heaters located in conditioned spaces (HVAC-R 10.1).*

- *Fireplaces that are not mechanically drafted or direct-vented to the outdoors must meet maximum allowed exhaust flow or pressure differential (HVAC-R 10.2).*

Additional Indoor airPLUS Requirements:

- Do not install any unvented combustion space-heating appliances.

- Ensure naturally drafted fuel-burning appliances located in conditioned spaces are installed in compliance with ASHRAE 62.2-2010 (Section 6.4) or conduct a worst case depressurization combustion air zone (CAZ) test according to an established protocol.

- Ensure that all fireplaces and other fuel-burning and space-heating appliances located in conditioned spaces are vented to the outdoors and supplied with adequate combustion and ventilation air according to the manufacturers' installation instructions.

- Meet the following energy efficiency and emissions standards and restrictions for all fireplaces and other fuel-burning and space-heating appliances located in conditioned spaces:

  - Traditional masonry fireplaces designed for open fires are not permitted, with the exception of "masonry heaters" as defined by ASTM E1602 and section 2112.1 of the 2012 International Building Code (i.e., fireplaces engineered to store and release substantial portions of heat generated from a rapid burn).

  - Factory-built wood-burning fireplaces shall meet the certification requirements of UL 127 and emission limits found in the EPA Standard for New Residential Wood Heaters.

  - Natural gas and propane fireplaces shall be mechanically drafted or direct vented, as defined by NFPA 54, section 3.3.108, have a permanently affixed glass front or gasketed door and comply with ANSI Z21.88/CSA 2.33.

  - Wood stove and fireplace inserts as defined in section 3.8 of UL 1482 shall meet the certification requirements of that standard, and they shall meet the emission requirements of the EPA Standards for New Residential Wood Heaters and WAC 173-433-100 (3).

  - Pellet stoves shall meet the requirements of ASTM E1509.

  - Decorative gas logs as defined in K.1.11 of NFPA 54 (National Fuel Gas Code) are not permitted.

- **Note:** Unfinished basements and crawlspaces (except raised pier foundations with no walls) and attached garages that are air-sealed to the outside and intended for use as work or living space, are considered "conditioned spaces" for the purpose of this requirement.

- **Exception:** Houses with no combustion heating equipment located in conditioned spaces.

5.2 Carbon Monoxide Alarms

Indoor airPLUS Requirement:

- All homes equipped with combustion appliance(s) or an attached garage shall have a carbon monoxide (CO) alarm installed in a central location in the immediate vicinity of each separate sleeping zone (e.g., in a hallway adjacent

to bedrooms.) The alarm(s) shall be hard-wired with a battery back-up function and placed according to NFPA 720. The alarms shall be certified by either CSA 6.19-01 or UL 2034.

5.3 Multi-Family Environmental Tobacco Smoke Protections

Indoor airPLUS Requirements:

- Reduce exposure to environmental tobacco smoke (ETS) in multi-family buildings by:

  ○ Prohibiting smoking in indoor common areas, specified explicitly in building rental/lease agreements or condo/co-op association covenants and restrictions.

  ○ Locating designated outdoor smoking areas a minimum of 25 ft. from entries, outdoor air intakes and operable windows.

  ○ Minimizing uncontrolled pathways for ETS transfer between individual dwelling units by sealing penetrations in the walls, ceilings and floors of dwelling units; sealing vertical chases adjacent to dwelling units; and applying weather stripping to all doors in dwelling units leading to common hallways.

5.4 Attached Garages

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Isolate attached garages from conditioned spaces as follows:*

  ○ *Air-seal common walls and ceilings between attached garages and living spaces before installing insulation (TES 3 and 5).*

  ○ *Use weather stripping or equivalent gasket to ensure all doors between living spaces and attached garages are substantially air-tight (TES 5.3.1).*

Additional Indoor airPLUS Requirements:

- Install an automatic door closer on all connecting doors between living spaces and attached garages.

- Equip each attached garage with an exhaust fan with a minimum installed capacity of 70 cfm, installed to vent directly outdoors. If a ducted fan (not through-the-wall) is used, test and verify minimum capacity of 70 cfm.

  ○ Wire each exhaust fan for continuous operation OR,

  ○ Install with automatic fan controls (e.g., a motion detector) that activate the fan whenever the garage is occupied and operate for at least 10 minutes after the garage has been vacated.

○ **Advisories:**

1. Exhaust fans wired for continuous operation are recommended as the preferred option to ensure removal of contaminants from garages. If the automatic fan control option is used, EPA recommends that the exhaust fan operates for 1 hour after the garage has been vacated.

2. ENERGY STAR certified fans are highly recommended.

6. Low-Emission Materials

Note: The evaluation, certification and labeling of products for indoor emissions of volatile organic compounds (VOCs) is complex and evolving. EPA has not established threshold levels for indoor VOC emissions from any of the product categories addressed in these specifications. The third-party programs referenced in these specifications include U.S. programs that are designed to reduce human exposure indoors to individual VOCs of potential concern for human health effects, compared to similar products not certified as low-VOC or no-VOC. EPA will consider modifying these specifications to include additional third-party programs as appropriate.

6.1 Composite Wood

Indoor airPLUS Requirements:

- For structural plywood and oriented strand board (OSB), use only products certified as compliant with PS1 or PS2, as appropriate, and made with moisture-resistant adhesives as indicated by "Exposure 1" or "Exterior" on the American Plywood Association (APA) trademark.

- Use only hardwood plywood products certified as compliant with the formaldehyde emissions requirements of ANSI/HPVA HP-1-2009 and U.S. HUD Title 24, Part 3280, OR certified compliant with CA Title 17.

- Use only particleboard and MDF products certified as 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 that are certified to comply with all the appropriate standards above OR registered brands or products produced in registered plants certified under KCMA's Environmental Stewardship Certification Program (ESP 05-12).

- **Note:** In California, use only composite wood products certified as compliant with CA Title 17 as appropriate.

6.2 Interior Paints and Finishes

Indoor airPLUS Requirements:

- For interior paints and finishes composing 90 percent or more of the interior surface area covered by such products, use only products certified as low-VOC or no-VOC by one of the following:

  ○ Green Seal Standard GS-11 (Third Edition, August 17, 2011), OR

  ○ Greenguard Certification for Paints and Coatings, OR

  ○ Scientific Certification Systems (SCS) Standard EC-10.2-2007, Indoor Advantage Gold, OR

  ○ Master Painters Institute (MPI) Green Performance Standards X-Green, GPS-1 or GPS-2, OR

  ○ A third-party low-emitting product list based on CA Section 01350 (CDPH Standard Method V1.1-2010), e.g., the CHPS List at http://www.chps.net/dev/Drupal/node/445.

6.3 Carpets and Carpet Adhesives

Indoor airPLUS Requirements:

- For carpets and carpet adhesives composing 90 percent or more of the finished surface area covered by such products, use only products labeled with, or otherwise documented as meeting, the Carpet and Rug Institute (CRI) Green Label Plus testing program criteria.

- For carpet cushion (i.e., padding), use only products certified to meet the CRI Green Label testing program criteria.

7. Home Commissioning

7.1 HVAC and Ductwork Verification

NOTE: Completion of the ENERGY STAR checklists now satisfies the following Indoor airPLUS requirement:

- *Verify that HVAC systems and ductwork are installed according to their design, as documented by a completed and verified ENERGY STAR HVAC System QI Contractor Checklist and ENERGY STAR HVAC System QI Rater Checklist (HVAC-C and HVAC-R).*

Additional Indoor airPLUS Requirements:

- Inspect ductwork before installing registers, grilles and diffusers to verify it is dry and substantially free of dust or debris. If duct openings were not covered during construction, thoroughly vacuum out each opening prior to installing registers, grilles and diffusers.

- Inspect air-handling equipment and verify that heat exchangers/coils are free of dust caused by construction activities (e.g., drywall, floor sanding) AND the filter is new, clean and meets specified MERV rating (see Specification 4.7).

7.2 Ventilation after Material Installation

Indoor airPLUS Requirements:

- Ventilate the home with outside air at the highest rate practical, meeting ventilation requirements for outdoor air flow and humidity control (see Specifications 4.5 and 4.8):

  ○ During and shortly after installing products that are known sources of contaminants (e.g., cabinets, carpet padding and painting), AND

  ○ During the period between finishing and occupancy.

- **Advisory:** If whole house ventilation cannot be scheduled prior to occupancy, advise the buyer to operate the ventilation system at the highest rate it can provide during the first few months of occupancy, meeting the above requirements.

7.3 Buyer Information Kit

Indoor airPLUS Requirements:

- Provide buyers with information and documentation of the home's IAQ protections, including:

  ○ A copy of the Indoor airPLUS Verification Checklist or other written documentation indicating compliance with all required measures from the Indoor airPLUS Construction Specifications, signed by an official representative of the builder.

  ○ HVAC, duct and ventilation system design documentation (i.e., airflow requirements) or performance test results (i.e., measured cfm) required by Specifications 4.1, 4.2 and 4.5, respectively, and a description of the ventilation system (i.e., system type, components and controls).

  ○ Operations and maintenance instruction manuals for all installed equipment and systems addressed by Indoor airPLUS and ENERGY STAR requirements, including HVAC systems and accessories, combustion appliances and any radon system.

Abbreviations

ICC – ES AC 243	International Code Council Evaluation Service Acceptance Criteria 243
CEC	California Energy Commission
CFDS	Composite Foundation Drainage System
cfm	cubic feet per minute
fpm	feet per minute
ft.	feet
HERS	Home Energy Rating System
HVAC	heating, ventilating and air-conditioning
IAQ	indoor air quality
in.	inches
mil	common term to describe plastic sheeting thickness; 1 mil equals 0.001 inches
min.	minimum
MDF	medium density fiberboard
MERV	Minimum Efficiency Reporting Value; defined in ASHRAE 52.2-2007
OSB	oriented strand board
Pa	Pascal
pCi/L	picocuries per liter
Rev.	Revision
sq. ft.	square foot
spec	specification
VOC	Volatile Organic Compound
w.c.	water column

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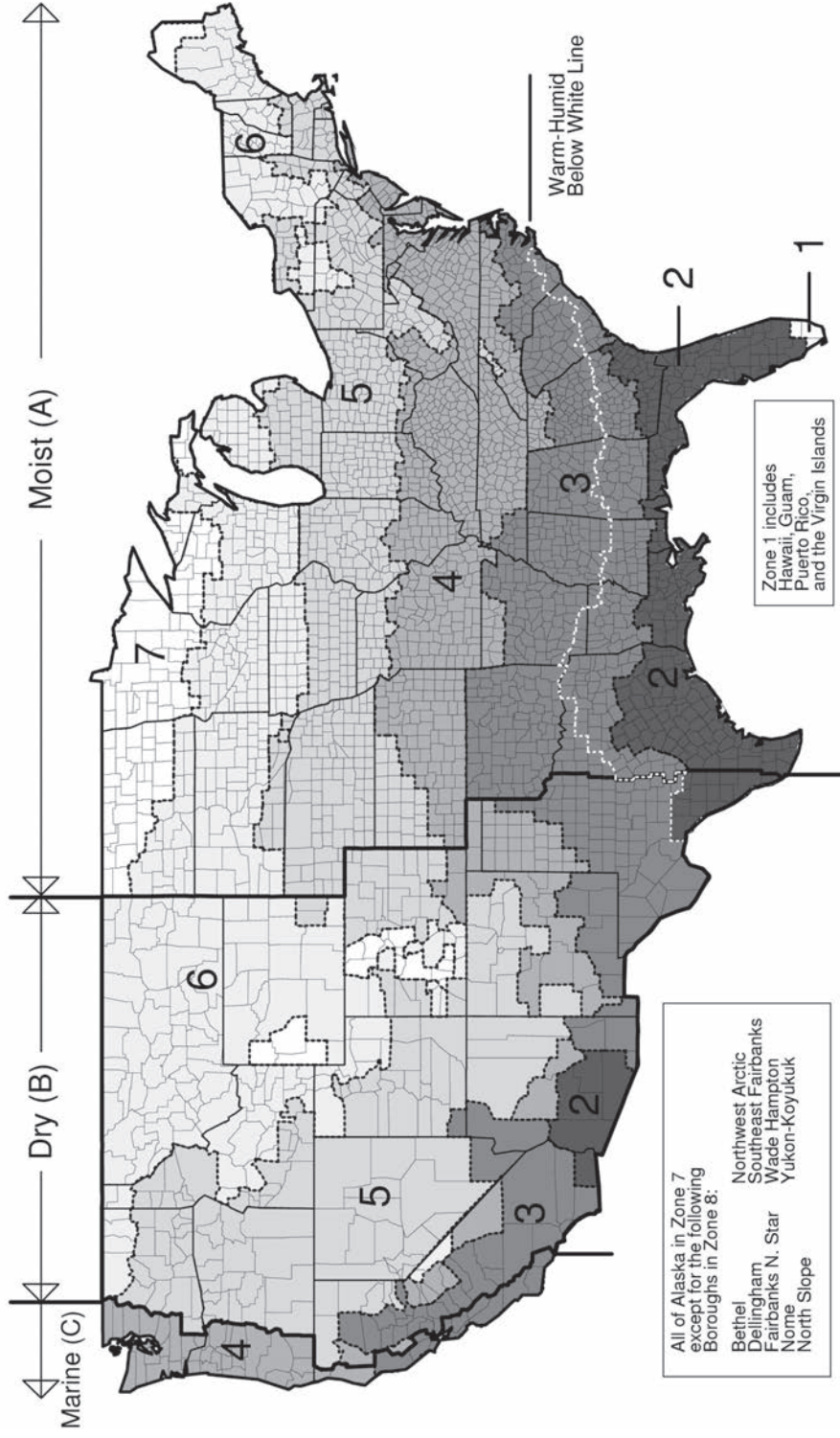
Climate Zones of the Continental United States

All of Alaska in Zone 7 except for the following Boroughs in Zone 8:

Bethel	Northwest Arctic
Dellingham	Southeast Fairbanks
Fairbanks N. Star	Wade Hampton
Nome	Yukon-Koyukuk
North Slope	

Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands

Warm-Humid Below White Line

Moist (A)

Dry (B)

Marine (C)

Figure 301.1, 2006 International Energy Conservation Code®

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compared to homes built to minimum code.

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