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# VERSION 2

# Indoor airPLUS

## New Construction (IAP-NC) Specifications





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## About the Indoor airPLUS Construction Specifications

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

The Indoor airPLUS Program fully integrates ENERGY STAR Single-Family New Homes and Multifamily New Construction requirements as a prerequisite. In addition, both the ENERGY STAR label and the Indoor airPLUS label are prerequisites for the Department of Energy’s Zero Energy Ready Homes Program and the PHIUS+ certification by Passive House Institute US, both of which are additional certification options in constructing high performance, sustainable buildings.

In addition to these Construction Specifications, the Indoor airPLUS Program periodically publishes a Policy Record document. The Policy Record is used to provide updates on the resolution of issues, including clarifications, refinements, and/or changes to program requirements. Policy Record updates may be made more frequently than revisions to the Construction Specifications. As such, the Policy Record should be referenced alongside the Construction Specifications for the most current program requirements and interpretations.

The Construction Specifications, Policy Record, and other program documents can be found at [www.epa.gov/indoorairplus/indoor-airplus-program-documents](http://www.epa.gov/indoorairplus/indoor-airplus-program-documents).

**NOTE: Although these measures are designed to help improve IAQ in new residences compared with residences built to minimum code, they alone cannot prevent all IAQ problems. For example, occupant behavior such as smoking/vaping indoors, routine home cleaning practices, regular maintenance of mechanical systems, and conscientious use of mechanical equipment during unusual events (e.g. power outages, wildfires, etc.) are also important factors that impact IAQ.**

## What's New in Version 2?

With a decade of positive growth, Version 2 of Indoor airPLUS reflects the program's ongoing commitment to supporting the building industry as EPA strives to improve indoor air quality (IAQ) for occupants with cost-effective design approaches and specifications for builders to encourage improved construction practices and technologies. Third-party verification of these program requirements offers a certification and label that the builder can use to promote their comprehensive approach to enhanced IAQ.

As industry knowledge has grown and tools and techniques have improved, Indoor airPLUS Version 2 has also evolved, proposing revised specifications for the new construction market and an expansion of project eligibility to include multifamily buildings of all heights. EPA also intends to include a certification opportunity for existing homes in a future update to Version 2. Key technical changes being proposed to the Indoor airPLUS New Construction Specifications include mandatory requirements for balanced dwelling-unit ventilation, improved performance for filtration, lower envelope air leakage allowances, additional humidity control and local exhaust requirements, and quality assurance measures in verification, among others. Terminology has also been updated and/or clarified in some cases. For example, Section 4 which covers Heating, Ventilation, and Air Conditioning (HVAC) systems includes some requirements that are specific to only Heating and Cooling (HAC) systems. This distinction recognizes that ventilation may perform as a separate system and may also require discrete specifications, independent from space conditioning systems. Additional advisories are also included as recommendations for improved practices which may become future program requirements, as codes, standards, emerging technologies, and building science research continue to progress.

Additional updates in Indoor airPLUS Version 2 include formatting updates to both the specifications and the checklist. In Version 1, Revision 4, numerous specification items were not included in the checklist if they were overlapping ENERGY STAR requirements. In Version 2, all the specifications have been reincorporated into the checklist, with gray highlighting indicating any overlapping ENERGY STAR requirements. While it may appear that the number of requirements has increased significantly, many of these requirements already existed but were obscured in the context of the checklist. This change is intended to improve clarity on the comprehensive set of requirements, while also improving verification and quality assurance.



**Certified homes and apartments earn the Indoor airPLUS label. Place it next to the ENERGY STAR label.**

## Eligibility and Verification Requirements

Homes or multifamily buildings that are eligible for certification under the ENERGY STAR Certified Homes and Multifamily New Construction programs are eligible to earn the Indoor airPLUS label. For a home or apartment to earn the Indoor airPLUS label, it must also be certified under the ENERGY STAR Certified Homes or ENERGY STAR Multifamily New Construction Program. Requirements for both Indoor airPLUS and ENERGY STAR can generally be verified simultaneously and must be conducted by a Certified Rater, Approved Inspector, or an equivalent designation as determined by a Home Certification Organization or Multifamily Review Organization. Instructions and guidance for Indoor airPLUS verification are listed below the Verification Checklist. While certification will result in compliance with many code requirements, a Rater is not responsible for ensuring that all code requirements have been met prior to certification. In the event that a code requirement, a manufacturer's installation instructions, or an engineering document conflicts with an Indoor airPLUS requirement, then the conflicting requirement within these program requirements shall not be met. Certification shall only be allowed if the Rater has determined that no equivalent option is available that could meet the intent of the conflicting requirement.

## Terms Used in This Document

**ADVISORIES** provide additional guidance to be considered but are not specification requirements. Advisories may become requirements in a future revision or version.

**EXCEPTIONS** to the requirements described in these construction specifications are noted as appropriate. For climate exceptions, refer to the 2018 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.

**ALTERNATIVE PATHS** provide additional requirements that may be applicable only to specific types of projects, typically for gut-rehabilitations.

**MULTIFAMILY** in the context of these Construction Specifications describes a building with three or more dwelling or sleeping units.

**COMMON SPACE** refers to any spaces in the building being labeled that serve a function in support of the residential part of the building that is not part of a dwelling or sleeping unit. This includes spaces used by residents, such as corridors, stairs, lobbies, laundry rooms, exercise rooms, residential recreation rooms, and dining halls, as well as offices and other spaces used by building management, administration or maintenance in support of the residents. Common space does not include commercial space



# Indoor airPLUS New Construction Version 2 Verification Checklist



<b>Home/Building Address:</b>		<b>City:</b>	<b>State:</b>	<b>Zip:</b>						
<b>Climate Zone (1-7):</b>		<b>Moisture Zone (A-C):</b>		<b>Radon Zone (1-3):</b>						
Section	Requirements (Refer to full Indoor airPLUS Construction Specifications for details)	Must Correct	Builder Verified	Rater Verified	N/A					
<b>ENERGY STAR</b>	<i>Note: Checklist items in grey in Sections 1 are ENERGY STAR Water Management System requirements that are verified using this checklist. All other ENERGY STAR requirements are documented using the appropriate ENERGY STAR checklist.</i>									
	<i>ENERGY STAR requirements in Sections 3-5 pertaining to air sealing, HVAC, and combustion pollutants have been met and ENERGY STAR certification documentation collected.</i>									
<b>Moisture Control</b>	1.1	Attached slabs, walks and driveways sloped away from building AND back-fill tamped and final grade sloped away from building.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	Exception Applied: <input type="checkbox"/> Swales or drains <input type="checkbox"/> Non-settling compact soils <input type="checkbox"/> Builder final back-fill after settling									
	1.2	Drain tile or Composite Foundation Drainage System sloped to discharge to outside grade.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
		Exception Applied: <input type="checkbox"/> Group 1 soils <input type="checkbox"/> Gut rehab w/ interior drainage to sump pump.								
	Sump pump covers mechanically attached with full gasket seal or equivalent.						<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1.3	Floor drain installed at lowest area in basements and crawlspaces.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.4	Capillary break installed under or on top of footings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.5	Capillary break installed beneath all slab floors.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
		Exception Applied: <input type="checkbox"/> Dry climate								
		Layer of aggregate or sand (4 in.) under basement slab OR layer of sand (4 in.) with geotextile matting installed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	Exception Applied: <input type="checkbox"/> Free-draining soils <input type="checkbox"/> Dry climate									
	1.6	Cover crawlspace floor with concrete slab over polyethylene or XPS OR install polyethylene by sealing or taping all seams, penetrations, and to walls and piers.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.7	All below-grade masonry, concrete, and wood-framed walls finished with appropriate waterproofing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.8	All basements and crawlspaces sealed to prevent air infiltration.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
		In moisture zones A and C, basements and crawlspaces are conditioned or dehumidified.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.9	Continuous water-resistive barrier behind exterior wall cladding; flashing at horizontal interruptions; stucco and masonry include weeps and additional moisture break.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.10	Fully flash all window and door openings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
	1.11	Direct roof water away from building.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
		Protection from water splash damage if no gutters.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>				
		Method: <input type="checkbox"/> Foundation wall 16" above grade <input type="checkbox"/> 16" drip line at eaves <input type="checkbox"/> Decay resistant cladding materials								
1.12	All roof-to-wall intersections and roof penetrations fully flashed AND "kick-out" flashing installed at low end of roof-to-wall intersections.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.13	Self-sealing bituminous membrane or equivalent (per 2009 IRC Section R905) installed at all valleys and roof decking penetrations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	Exception Applied: <input type="checkbox"/> Dry climate									
Low sloped or flat roofs sloped to insulated drains; roof penetrations integrated into drainage plane and water control layer overlapped.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.14	Ice flashing over the sheathing at eaves in climate zone 5 and higher.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.15	Install moisture-resistant backing material in showers and tubs.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.16	Corrosion-resistant drain pan connected to a drain for condensate-producing HVAC components.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	Hot water storage tanks adjacent to finished spaces include drain pan and drain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	Non-vented clothes dryers plumbed to a drain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.17	Supply piping in exterior walls insulated with pipe wrap.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
	Exception Applied: <input type="checkbox"/> Dry climate AND climate zone 1-3. <input type="checkbox"/> Air barrier insulation in wall cavity.									
1.18	Hard-surface flooring in kitchens, baths, entry, laundry, and utility rooms.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.19	No Class 1 vapor retarders on interior side of vapor permeable insulation in below-grade exterior walls or in any exterior walls in Warm-Humid climates.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					
1.20	Materials with visible signs of water damage not installed, AND high moisture content products not enclosed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>					

Radon	2.1	In EPA Radon Zone 1: (Active radon mitigation system OR passive system and test upon completion.)	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		In EPA Radon Zone 2: (Passive radon reduction system OR test upon completion.)	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		In EPA Radon Zone 3: (Comply with RZ 1 or 2 options OR provide occupants with EPA's Citizen's Guide to Radon.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		System type and test result (if applicable): <input type="checkbox"/> Passive <input type="checkbox"/> Active <input type="checkbox"/> Test result _____ piC/L				<input type="checkbox"/>
		Exception Applied: <input type="checkbox"/> Raised-pier foundation w/ no conditioned ground contact. <input type="checkbox"/> Multifamily building meeting AARST CC-1000 4.8.				
	2.2	Verify the following requirements where a passive or active radon system is installed:				
		a. Capillary break and soil gas retarder installed according to Specification 1.4, irrespective of climate zone.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		b. Vent pipe requirements met.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		c. Foundation drainage system isolated from soil gas collection plenum.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		d. Radon fan (if active) OR electrical receptacle (if passive) installed outside pressure boundary, meeting fan location requirements.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
e. Branch circuit labeled at electrical panel.		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
f. Foundation air sealing requirements met.		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
g. Where active system is installed, negative pressure meter and fan failure alarm are also installed.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Pests	3.1	Foundation and slab requirements are met per termite infestation classification: <input type="checkbox"/> Moderate to Heavy <input type="checkbox"/> Very Heavy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	3.2	Screens provided for operable windows.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Corrosion-proof rodent/bird screens installed at all openings that cannot be fully sealed.	<input type="checkbox"/>		<input type="checkbox"/>	
3.3	Multifamily projects include pest management plan, sanitary floor drains in common trash/recycle rooms, and resident guidance.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
HVAC Systems	4.1	Heating/cooling design loads for dwelling units calculated, regardless of HAC system type.	<input type="checkbox"/>		<input type="checkbox"/>	
		HAC systems selected per ACCA Manual S, including boilers and non-ducted systems. <input type="checkbox"/> Exception: Where systems are not within the scope of Manual S, smallest equipment size selected that meets the loads.	<input type="checkbox"/>		<input type="checkbox"/>	
	4.2	Common space design loads calculated according to ANSI/ACCA/ASHRAE Standard 183 and HAC duct systems designed according to ASHRAE Handbook of Fundamentals.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		HAC ducts sealed at joints, seams, and penetrations, and duct boots sealed to finished surfaces.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		HAC duct systems protected from construction debris AND duct boots vacuumed.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4.3	No building cavities used as air supplies or returns.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		No air-handling equipment or ductwork outside thermal and air barrier boundary. Exception Applied: <input type="checkbox"/> < 10' <input type="checkbox"/> Embedded ducts per climate zone <input type="checkbox"/> Jump ducts <input type="checkbox"/> Located in dehumidified crawl/basement <input type="checkbox"/> Make-up air or DOAS	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Air-handling equipment meets access requirements.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		No air-handling equipment or ductwork located in garages. Exception Applied: <input type="checkbox"/> Multifamily buildings where system provides independent heating/ventilation for garage. <input type="checkbox"/> One-family, two-family, or townhouse where mechanical closet is accessed from garage but meets the additional requirements.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4.4	Pressure differentials for bedrooms in dwelling units in multifamily buildings with design airflows less than 150 cfm, measured within 3 Pa of the main body of the dwelling unit.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4.5	All dwelling units supplied with outdoor air using a balanced ventilation system with MERV 13 filtration. Where connected to the HAC air handler or ducting, requirements for interlocking and/or controls are met.	<input type="checkbox"/>		<input type="checkbox"/>	
		Dwelling-unit mechanical ventilation components, filters, and terminations are accessible.	<input type="checkbox"/>		<input type="checkbox"/>	
		Measured outdoor air rates meet requirements of ASHRAE 62.2-2013 or later.	<input type="checkbox"/>		<input type="checkbox"/>	
	4.6	Intermittent bathroom and kitchen exhaust fans rated for maximum of 2 sones. Exception Applied: <input type="checkbox"/> Remote mounted fan <input type="checkbox"/> Kitchen fan over 400 cfm.	<input type="checkbox"/>		<input type="checkbox"/>	
		Fans providing local exhaust to bathrooms, that do not operate continuously, are provided with automatic controls that operate for 30 minutes after vacated or until humidity is less than 60%.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Range hood or downdraft kitchen exhaust fan installed that vents to outdoors and meets Rater-measured exhaust rate requirements. Exception Applied: <input type="checkbox"/> In dwelling units in multifamily buildings, continuous kitchen exhaust is installed at the required distance from the stove, with a MERV 3 or washable filter, and a recirculating range hood with charcoal filter is installed above the stove.	<input type="checkbox"/>		<input type="checkbox"/>	
		Where present, continuous kitchen exhaust fan rated for maximum of 1 sone.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>

	4.7	MERV 13 filter installed in outdoor air supply system serving common spaces AND system components are accessible.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Vented clothes dryers exhaust to outdoors.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Central vacuum systems vented outdoors, minimum 10 ft from air inlets.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4.8	All ducted HAC systems have minimum MERV 13 filter, verified to be in good, clean condition after construction completion.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Where installed, electronic air cleaners do not exceed ozone emission limits.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	4.10	Humidity monitoring provided.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
For dwelling units in Moist (A) climates zones 1-4, equipment installed to maintain indoor RH at or below 60 percent.		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
4.11	No ozone generators or devices intentionally producing ozone to treat or condition air are installed.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Combustion Pollutants	5.1	No unvented combustion appliances or naturally drafted furnaces, boilers, water heaters within pressure boundary.	<input type="checkbox"/>		<input type="checkbox"/>	
		Indoor air quality monitoring devices installed where solid fuel burning appliances installed.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Venting, efficiency, and emissions standards met for combustion appliances. Identify allowable appliance type: <input type="checkbox"/> Masonry heater <input type="checkbox"/> Factory-built wood-burning fireplace <input type="checkbox"/> Wood stove <input type="checkbox"/> Pellet stove <input type="checkbox"/> Natural gas/propane fireplace Appliance model name(s)/number(s): _____	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	5.2	CO alarms labeled and placed in accordance with NFPA 72 with minimum 10-year non-replaceable batteries.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	5.3	Multifamily buildings: Smoking/vaping prohibitions for 4 or more attached units.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	5.4	Attached dwelling units: Measured compartmentalization less than or equal to 0.23 CFM <sub>50</sub> per square foot.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
		Detached homes: Measured airtightness less than or equal to 3 ACH <sub>50</sub> .	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	5.5	Automatic door closer between occupied spaces and attached garages or parking structures.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
Detached one- and two- family homes and townhouses: <input type="checkbox"/> Pressure test conducted to verify effectiveness of garage-to-house air barrier; OR <input type="checkbox"/> 100 cfm exhaust fan installed in garage and verified.		<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Materials	6.1	All composite wood products labeled TSCA Title VI compliant.	<input type="checkbox"/>		<input type="checkbox"/>	
	6.2	Interior paints and finishes meet low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	
	6.3	Carpet and carpet cushion meet low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	6.4	Adhesives and sealants meet low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	
	6.5	Hard surface flooring meets low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	
	6.6	Gypsum board meets low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
	6.7	Insulation meets low-emission requirements. See spec.	<input type="checkbox"/>		<input type="checkbox"/>	
	6.8	Building ventilated at highest rate and duration practical before occupancy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Info Kit	7.1	Equipment manuals, operation and maintenance recommendations, Indoor airPLUS label, and Indoor airPLUS certificate provided for owner, resident, or property manager.	<input type="checkbox"/>		<input type="checkbox"/>	

<p><b>Rater Company:</b> _____</p> <p><b>Rater Employee:</b> _____</p> <p><b>Rater Signature:</b> _____ <b>Date:</b> _____</p>	<p><b>Builder Company:</b> _____</p> <p><b>Builder Employee:</b> _____</p> <p><b>Builder Signature:</b> _____ <b>Date:</b> _____</p> <p><input checked="" type="checkbox"/> If builder-verified items were checked, no sampling was used.</p>
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## Guidance for Completing the Indoor airPLUS Verification Checklist

1. Only homes or apartments certified under the ENERGY STAR Certified Homes or Multifamily New Construction program and 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.

Note: ENERGY STAR footnotes and exceptions will always be utilized unless otherwise noted in the Indoor airPLUS Construction Specifications. In some cases, Indoor airPLUS modifies or excludes certain ENERGY STAR exceptions or alternate pathways.

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. Items may be verified visually by the Rater 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. At the discretion of the Rater, the builder or developer may verify any items in the checklist with an optional field labeled “Builder Verified”. For the purpose of this checklist, “Builder” represents either the builder or the developer. When exercised, the builder’s responsibility will be formally acknowledged by the builder, or their designated agent, signing off on the checklist for the item(s) that they verified. However, if a quality assurance review indicates that items have not been successfully completed, the Rater will be responsible for facilitating corrective action.
4. The Rater shall retain the rating documentation, all required ENERGY STAR Certified Homes or Multifamily New Construction documentation, and the Indoor airPLUS Verification Checklist for the home or multifamily building for a minimum of 3 years from final verification. The Rater shall coordinate with the Provider and/or builder/developer to provide an Indoor airPLUS label and certificate for each qualified home/unit.
5. Raters who operate under a Sampling Provider are permitted to verify the Minimum Rated Features of the home/unit and to verify any checklist item designated “Rater Verified” using an HCO-approved sampling protocol for ENERGY STAR and Indoor airPLUS homes/units located outside California, and a sampling protocol approved by the California Energy Commission for homes/units located in California. For example, if the approved sampling protocol requires rating one in seven homes/units, then the checklist will be completed for the one home/unit that was rated. Only Raters are permitted to use sampling. All other items shall be verified for each certified building. No builder-verified items are permitted to be verified using a sampling protocol. However, a single signed copy of the checklist is permitted for an entire building or group of units with the same features.

***For further information on the Indoor airPLUS program, visit [www.epa.gov/indoorairplus](http://www.epa.gov/indoorairplus).***



# Indoor airPLUS New Construction Certification Specifications

## Version 2

ENERGY STAR certification is a pre-requisite for a residence to achieve Indoor airPLUS qualification. ENERGY STAR checklist items that satisfy Indoor airPLUS requirements are only summarized below. Please refer to the [ENERGY STAR Residential New Construction Program website](#) for more information and the full description of the requirements. Depending on your state, newer versions of the ENERGY STAR Program Requirements may be in effect (e.g. ESCH V3.2, MFNC V1.2).

## 1. Moisture Control

### Water-Managed Site and Foundation

#### 1.1 Site Drainage

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

- ✓ Attached slabs, such as patio, porches, walkways, and adjacent walks and driveways sloped  $\geq 0.25$  in. per ft. away from home to edge of surface or 10 ft., whichever is less.
- ✓ Back-fill has been tamped and final grade sloped  $\geq 0.5$  in. per ft. away from the home for  $\geq 10$  ft.

*Exceptions:*

- 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.
- Tamping of back-fill is not required if either:
  - Proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or engineer; OR,
  - The builder has scheduled a site visit to provide in-fill and final grading after settling has occurred.

#### No Additional Indoor airPLUS Requirements

#### 1.2 Foundation Drainage

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

- ✓ Drain tile or Composite Foundation Drainage System (CFDS) installed at basement and crawlspace walls and sloped to discharge to outside grade (daylight) or to a sump pump, sewer, or runoff management system.
  - o For drain tile: top of pipe is installed below the bottom of the concrete slab or crawlspace floor; AND pipe is pre-wrapped with filter fabric or is surrounded with  $\geq 6$  in. of  $\frac{1}{2}$  to  $\frac{3}{4}$  in. washed or clean gravel, with gravel layer fully wrapped with fabric cloth. Drain tile is level or sloped to discharge to outside grade (daylight) or to a sump pump. If drain tile is on interior side of footing, then a channel is provided through footing to exterior side.
  - o For CFDS: the system must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use.
- ✓ Sump pump covers mechanically attached with full gasket seal or equivalent.

*Exceptions:*

- In an existing home (e.g. in a home undergoing a gut rehab.) a drain tile installed only on the interior side of the footing without a channel is permitted.
- A foundation drainage system is not required when a certified hydrologist, soil scientist, or engineer has determined that the foundation rests on Group I Soils (i.e. well-drained ground or sand-gravel mixtures), as defined by 2018 IRC Table R405.1.

#### No Additional Indoor airPLUS Requirements

#### 1.3 Floor Drain

- In buildings with a basement or crawlspace, install a floor drain in the lowest floor area to mitigate risk from internal bulk water events, discharging to daylight on sloped final grade per Item 1.1 or into an approved sewer or drainage system. Floor drains shall include trap seal protection according to 2018 IRC 3201.2.1. Sump pits are permitted to have drains integrated with the sump cover, so long as the cover is mechanically attached with a full gasket seal and the integral drain has a trap or similar means to reduce soil gas entry.

**Advisory:** Combination foundations (e.g. basement with separated crawlspace) are recommended to have a means of discharging bulk water from each separate foundation area, in the case of interior water events (e.g. plumbing malfunction, flooding, etc.).

#### 1.4 Capillary Break – Footers

- Capillary break installed under or on top of all new footers using either:
  - 6 mil (or thicker) polyethylene sheeting; **OR**
  - Bituminous membrane; **OR**
  - Liquid waterproofing.

**Exception:**

- Gut rehabs in which existing footers are not exposed.

#### 1.5 Capillary Break – Slab-on-Grade and Basement Slabs

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

- ✓ *Capillary break beneath all slab-on-grade and basement slabs using either:*
  - 6 mil (or thicker) polyethylene sheeting, overlapped 6 in. (min.) at seams; **OR**
  - ≥ 1 in. extruded polystyrene (XPS) insulation with taped joints.

**Additional Indoor airPLUS Requirements:**

- Before installing concrete slab, install a 4 in. (min.) layer of ½ in. diameter or greater clean aggregate; **OR**
- Install ≥ 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.

**Exceptions:** (Not applicable where a passive or active radon system is installed)

- Dry climates, as defined by 2018 IECC Figure 301.1.
- Areas with free-draining soils – identified as Group 1 (Table R405.1, 2018 IRC) by a certified hydrologist, soil scientist, or engineer through a site visit.

**Alternative path for gut-rehabs:**

- For an existing slab in a home/building undergoing a gut rehabilitation in Radon Zones 2 and 3, in lieu of polyethylene and aggregate or sand under the slab, a continuous and sealed Class I or Class II vapor retarder is permitted to be installed on top of the slab. In such cases, up to 10% of the slab surface may be exempted from this requirement (e.g., for sill plates). In addition, for existing slabs in occupiable space, the vapor retarder shall be, or shall be protected by, a durable floor surface.

**Note:** Homes/buildings undergoing gut rehabilitation in Radon Zones 1 and 2 that maintain existing slabs must also install an active radon system utilizing sub-slab depressurization, and radon levels shall be verified upon final inspection to be below the EPA action level (4pCi/l) to be certified. (See Section 2).

#### 1.6 Capillary Break – Crawlspace

- Cover crawlspace floor with a concrete slab over the polyethylene or XPS as required for basement floors; **OR**
- Install the required polyethylene by sealing or taping all seams and penetrations and sealing to walls and piers (e.g. with adhesive and furring strips or similar mechanical fasteners and sealant).

**Advisory:** Polyethylene 10 mil or thicker is recommended if crawlspace floors are not covered with a concrete slab.

#### 1.7 Damp-Proofing and Waterproofing Below-Grade Exterior Walls

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

- ✓ *Exterior surface of below-grade walls of basements & unvented crawlspaces finished as follows:*
  - For poured concrete, masonry, & insulated concrete forms, finish with damp-proofing coating.
  - For wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.

**Alternative path for gut-rehabs:**

- Interior surface of an existing below-grade wall (e.g., in a home undergoing a gut rehab.) is permitted to be finished by:
  - Installing a continuous and sealed drainage plane, capillary break, Class I Vapor Retarder and air barrier that terminates into a foundation drainage system as specified in Item 1.2; **OR**
  - If a drain tile is not required as specified in Item 1.2, adhering a capillary break and Class I Vapor Retarder directly to the wall with the edges taped/sealed to make it continuous.

## 1.8 Basement and Crawlspace Conditioning

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

**Note:** Homes/buildings in areas designated as 100-year flood zones may need to utilize insulated, weather-stripped flood vents to meet the above requirement. Additional local requirements may also apply per jurisdiction. For more information on designated 100-year flood zones, see FEMA’s definition of Special Flood Hazard Areas: [www.fema.gov/flood-zones](http://www.fema.gov/flood-zones).

- In moisture zones A and C, as defined by 2018 IECC Figure 301.1:
  - Provide active dehumidification, sized for the total volume of the basement and/or crawlspace according to manufacturer’s recommendations, to maintain relative humidity (RH) at or below 60 percent. Dehumidifier shall be drained to the outside or to a sump pump; **OR**
  - For crawlspaces only—Provide conditioned air at a rate not less than 1 cfm per 50 sq. ft. of horizontal floor area. This can be achieved by a dedicated supply (2018 IRC section R408.3.2.2) or through crawl-space exhaust (2018 IRC section R408.3.2.1). However, if radon-resistant features are required (see Specification 2.1), do not use the crawlspace exhaust method unless active radon mitigation is also installed.

**Note:** When utilizing conditioned air from the Heating and Cooling (HAC) system, crawlspace and basement perimeter walls shall be insulated according to the prescriptive values determined by local code or R-5, whichever is greater.

### Advisories:

- Active dehumidification is recommended in crawlspaces and basements (in lieu of or in addition to space conditioning) to avoid humidity issues during “swing seasons” or low-load periods where space conditioning systems may not be operating regularly.
- A humidity monitoring device that includes a digital display of indoor temperature and RH and the ability to record data, either on-board or via a web-based app, is recommended in basements and crawlspaces in addition to similar RH monitoring in the main living area of the home/unit.

## Water-Managed Wall Assemblies

### 1.9 Water-Managed Wall Assemblies

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

- ✓ *Install a continuous Water-Resistive Barrier (WRB) behind exterior wall cladding that overlaps flashing and is fully sealed at all penetrations. Provide an additional moisture break between WRB behind all stucco and non-structural masonry cladding wall assemblies.*
- ✓ *Install flashing or an equivalent drainage mechanism at all horizontal interruptions and the bottom of exterior walls to direct water away from the WRB and foundation.*
- ✓ *Include weep holes for masonry veneer and weep screed for stucco cladding systems, per manufacturer specifications.*

### No Additional Indoor airPLUS Requirements

#### Advisories:

- Liquid or fluid applied membranes and integrated sheathing systems with sealed/taped seams should be applied and/or sealed on clean surfaces according to manufacturer’s instructions to perform as a WRB.
- Rainscreen assemblies with a minimum 3/16 in. air gap or drainage mat are recommended between the cladding and drainage plane.

### 1.10 Window and Door Openings

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

- ✓ *Apply a formed pan, flexible tape, or liquid applied pan flashing over the rough sill framing, inclusive of the sill corners, to direct the movement of water away from the opening and wall assembly. Install side flashing that extends over pan flashing and top flashing that extends over side flashing, or equivalent details for structural masonry or structural concrete walls.*

### No Additional Indoor airPLUS Requirements

## Water-Managed Roof Assemblies

### 1.11 Gutters, Downspouts and Roof Water Drainage

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

- ✓ *Direct roof water away from the building using gutters and downspouts that empty into lateral piping on a sloping finish grade a minimum of 5 ft. from foundation or into a sewer or rainwater management system, or direct roof water to a grade-level rock bed with a waterproof liner or an underground catchment system not connected to the foundation drain system that discharges water  $\geq$  10 ft. from foundation. (See exceptions in ENERGY STAR Water Management System Checklist).*

#### **Additional Indoor airPLUS Requirements:**

- In homes that meet exceptions to the requirement of gutters, provide extra protection for water splash damage using one of the following methods:
  - Extend the foundation walls at least 16 in. above final grade; **OR**
  - Provide a drip line at eaves that is horizontally 16 in. away from the edge of the foundation wall; **OR**
  - Use cladding materials that are decay and rot resistant and can tolerate regular wetting extending at least 16 in. above final grade.

### **1.12 Roof to Wall Intersections and Roof Penetrations**

*NOTE: Completion of the ENERGY STAR requirements 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.*
- ✓ *Install “kick-out” flashing at the low end of roof-to-wall intersections. Flashing shall extend at least 4 in. on the wall surface above the roof deck and shall be integrated with drainage plane above. Intersecting wall siding should terminate a minimum of 1 in. above roof, or higher per manufacturer’s recommendations.*

#### **No additional Indoor airPLUS Requirements**

### **1.13 Roof Valleys and Decking**

*NOTE: Completion of the ENERGY STAR requirements 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.*

*Exceptions:*

- *Not required in Dry (B) climates as shown in 2009 IECC Figure 301.1 and Table 301.1.*
- *Any option in 2009 IRC Sections R905.2.8.2 or R905.13 are permitted.*

#### **Additional Indoor airPLUS Requirements:**

- Low sloped or flat roofs (<2:12 pitch) shall meet the following criteria:
  - Low-slope roofs must be sloped to drains or scuppers at a minimum slope of ¼ inch per foot;
  - Insulate roof drains through roof structure to reduce the possibility of condensation;
  - Roof assembly air control layer must be connected over other roof elements (e.g. curbs and blocking) and connected to the wall air control layer;
  - Roof penetrations (e.g. drains, skylights, or mechanical curbs) must be integrated into the roof’s drainage plane, air sealed, and fully flashed;
  - Materials that form the water control layer must overlap each other in shingle fashion or be sealed in a watertight manner.

### **1.14 Roof Eaves**

*NOTE: Completion of the ENERGY STAR requirements satisfies the following Indoor airPLUS requirement:*

- ✓ *In 2018 IECC Climate Zones 5 & higher:*
  - *Install ice flashing over the sheathing at eaves to provide protection from ice dams. Extend a self-sealing bituminous membrane from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall.*

#### **No Additional Indoor airPLUS Requirements**

**Advisory:** Where permitted, install roof membrane prior to the drip edge installation and lapped down minimum of 1 in. onto the face of the fascia. After installation of the membrane and drip edge, install an additional self-sealing strip at least 4 in. wide on top of the drip edge.

## Interior Moisture Management

### 1.15 Moisture-Resistant Backing Materials

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

- ✓ *Install moisture-resistant backing material, such as cement board or equivalent, on all walls behind tub and shower enclosures composed of tile or panel assemblies with caulked joints. Paper-faced backer board shall not be used.*

**Note:** *In addition to cement board, materials that have been evaluated by ICC-ES per AC 115 may also be used to meet this requirement. Monolithic tub and shower enclosures (e.g., fiberglass with no seams) are exempt from this backing material requirement unless required by the manufacturer. Paper-faced backerboard may only be used behind monolithic enclosures or waterproof membranes that have been evaluated by ICC-ES per AC 115, and then only if it meets ASTM mold-resistant standards ASTM D3273 or ASTM D6329.*

### 1.16 Appliance Drainage

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

- ✓ *For each condensate-producing HVAC component, corrosion-resistant drain pan (e.g., galvanized steel, plastic) included that drains to a conspicuous point of disposal in case of blockage. Backflow prevention valve included if connected to a shared drainage system.*

#### Additional Indoor airPLUS Requirements:

- Hot water storage tanks located in, above, or adjacent to finished spaces shall include a corrosion-resistant drain pan (e.g., galvanized steel, plastic) that drains to a conspicuous point of disposal.
- Non-vented (condensing or heat pump) clothes dryers shall be plumbed to a drain according to the manufacturer's instructions.

### 1.17 Water Supply Pipes

- Insulate water supply pipes in exterior walls with minimum R4 pipe insulation.

#### Exceptions:

- Climate zones 1-3 located in dry climates, as defined by 2018 IECC Figure R301.1.
- When insulation in the wall cavity qualifies as an air barrier and pipes are located within the interior 50% of the wall cavity.

**Advisory:** Pipes should be installed as close as possible to conditioned space while maintaining Grade 1 insulation installation to reduce risk of freezing and/or condensation.

### 1.18 Water-Resistant Flooring

- In kitchens, bathrooms, entryways, laundry areas, and utility rooms, install only water-resistant hard-surface flooring within 4 ft. of any plumbing fixture or exterior door. Wall-to-wall carpeting is permitted in adjacent spaces (e.g. hallways) beginning at the interior of the jamb or opening.

**Note:** Wood flooring, either pre-finished or site-finished, can be utilized in these areas, as long as any composite wood material or site-applied finish comply with Items 6.1 and 6.2, respectively.

### 1.19 Class 1 Vapor Retarders

*NOTE: Completion of the ENERGY STAR requirements 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.*

**Note:** *Class 1 vapor retarders, such as mirrors, may be used if mounted with clips or other spacers that allow air to circulate behind them.*

### 1.20 Materials with Signs of Water Damage or Mold

*NOTE: Completion of the ENERGY STAR requirements 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 as the lumber is structurally intact.*
- ✓ *Do not enclose (e.g., with drywall) framing members and insulation products having high moisture content. (Note: Lumber should not exceed 18 percent moisture).*
- ✓ *For wet-applied insulation, follow the manufacturer's drying recommendations.*

**Advisory:** Ensure building materials are kept dry before installation and buildings are dried out during construction. Install water-resistive barriers and/or fenestrations immediately following rough framing, remove standing water, and use fans and/or dehumidifiers to remove moisture. If standing water or ice is found to be present following the completion of rough framing, the rater should request a root cause analysis and corrective action plan from the builder to be included and maintained with final verification documents.

## 2. Radon

### 2.1 Radon Zone Identification and Strategy

*NOTE: Consult EPA's radon zone map ([www.epa.gov/radon/zonemap.html](http://www.epa.gov/radon/zonemap.html)) to determine requirements below based on the location of the home or building being constructed. Voluntary consensus standards referenced below for best practices in radon resistant new construction (RRNC) and radon testing can be found at <https://standards.aarst.org/>.*

- Identify the Radon Zone where the project is located.
- In EPA Radon Zone 1, construct buildings with either:
  - An active radon mitigation system meeting the requirements outlined in Item 2.2; **OR**
  - A passive radon reduction system (see Item 2.2) and a test upon completion of construction confirming that radon levels are below 4 picocuries per liter (pCi/l).
- In EPA Radon Zone 2, construct buildings with either:
  - A passive radon reduction system meeting the requirements outlined in item 2.2; **OR**
  - Conduct a test upon completion of construction confirming that radon levels are below 4 pCi/l.
- In EPA Radon Zone 3, either:
  - Comply with one of the options for Radon Zones 1-2; **OR**
  - Provide the occupants of single-family homes and townhouses with EPA's Citizen's Guide to Radon along with the required equipment manuals and maintenance guidance in their IAQ information kit.

**Note:** Where radon testing is performed to meet the above requirements, testing shall follow protocols outlined in ANSI/AARST MAH for single-family dwellings OR ANSI/AARST/MAMF for multifamily buildings. If radon levels are found to be above 4 pCi/l, mitigation with an active radon system is required, followed by post-mitigation testing to confirm levels below 4 pCi/l.

#### Exceptions to the installation of Radon-Resistant Construction requirements:

- Passive or active radon systems are not required in:
  - Buildings with raised-pier foundations (i.e. no solid perimeter foundation wall) and no mechanical rooms or conditioned walk-up entry with ground contact.
  - Multifamily buildings with all dwellings located above garage spaces that meet exceptions for ventilated garages in Item 4.8 of ANSI/AARST CC-1000.

### 2.2 Radon-Resistant Construction

- During the installation of either a passive or active radon system, visually verify the following requirements:
  - a. Capillary break and soil gas retarder installed according to Specification 1.4, irrespective of climate zone.
 

**Exception:** In dry climates as defined by 2018 IECC Figure 301.1, either a layer of geotextile drainage matting or a "pipe loop" in a trench of clean aggregate along the entire inside perimeter of the foundation (installed according to ANSI/AARST CCAH 403.1.1) can be used in lieu of a uniform layer of aggregate under the entire slab.
  - b. A 3 or 4 in. diameter gas-tight vertical vent pipe, clearly labeled during all phases of construction as a component of a radon reduction 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. At least 10 ft. of horizontal perforated drain tile shall be attached to the T-fitting beneath the soil gas retarder placed over earthen crawlspaces and below concrete slabs. Note: suction points are not permitted on sump lids.
  - c. Where a foundation drainage system discharges to daylight and is also connected to the soil gas collection plenum of a passive or active radon system, include a backwater valve (check valve) or other means in the foundation drainage system to isolate the soil gas collection plenum from any openings to atmosphere (e.g. drain tile outfall, window wells).
  - d. Radon fan (in the case of an active system) OR an electrical receptacle (in the case of a passive system) is installed in an accessible attic location outside the pressure boundary of the home. When a passive system is installed, the electrical receptacle shall be within 6 ft. of the radon vent pipe to facilitate future fan installation if needed. A space surrounding the radon pipe, having a vertical height of not less than 36 inches and a diameter of not less than 21 inches, shall be provided in the attic area where the radon fan can be installed, if required. Homes with no accessible attic location for a fan must utilize another exterior location or a garage that is not below conditioned space per ANSI/AARST CCAH 701.2.
  - e. The branch circuit supply shall be labeled at the electrical panel indicating its intended use.

- f. Foundation air sealing with polyurethane caulk or the equivalent at all slab openings, penetrations and control or expansion joints.
- g. Where an active radon system is installed, system monitors shall be provided to notify occupants or building managers of fan failure. System monitors shall be connected to the fan piping and shall include both:
  - Negative pressure meter, such as a manometer type pressure gauge; **AND**
  - Fan failure notification by audible fan alarm or remote telemetry.

#### Requirements for gut-rehabilitations:

- For homes/buildings with an existing slab undergoing gut rehabilitation (gut-rehab) in Radon Zones 1 and 2, the slab is not required to be removed for the installation and inspection of the capillary break and soil gas collection area. However, in such cases, an active radon system must be installed, and testing shall be conducted upon final inspection to verify radon levels are below the EPA action level (4pCi/l) to receive the Indoor airPLUS label. Additionally, the alternate slab treatment in the ENERGY STAR Water Management System Builder Checklist, footnote 5, shall apply as an alternative to polyethylene and aggregate or sand under the slab.
- Occupants of single-family homes and townhouses undergoing gut-rehab in Radon Zone (RZ) 3 shall be provided with EPA's Citizen's Guide to Radon along with equipment manuals in their IAQ information kit, or the home shall otherwise meet the mitigation requirements for RZ 1-2.

**Note:** Consult local building codes to determine whether additional radon requirements or regulations apply. Also consult EPA's "Building Radon Out" (EPA 402-K-01-002) for general guidance on installing radon-resistant features.

#### Advisories:

1. Elevated levels of radon have been found in buildings built in all three zones on EPA's Map of Radon Zones. While it is commonly assumed that the lowest levels in the building will have the highest concentration of radon, that is not always the case; elevated levels of radon may be found on all levels in buildings. Consult your state radon program for current information about radon in your area. Go to [www.epa.gov/radon/wherelive.html](http://www.epa.gov/radon/wherelive.html) and click on your state for contact information.
2. In EPA Radon Zone 1, EPA recommends that radon-resistant features are installed according to ANSI/AARST CCAH for 1-2 family dwellings and townhouses (max. total foundation area of 2500 sq. ft.) OR ANSI/AARST CC-1000 for larger foundations. EPA also recommends radon-resistant features for buildings in EPA Radon Zones 2 and 3, and that all buildings with or without radon-resistant features be tested for radon prior to occupancy. An active radon mitigation system should be installed when the test result is 4 pCi/L (the EPA action level) or more.
3. Radon levels below 4 pCi/L still pose some risk, radon levels can be reduced to 2 pCi/L or below in most homes. If short-term testing results indicate radon levels  $\geq 2$  pCi/L, consider mitigating or performing a long-term test ( $\geq 90$  days) to acquire a more accurate representation of annual radon exposure in the home.
4. Provide buyers with EPA's "Citizen's Guide to Radon", encourage them to test for radon, and refer them to [www.epa.gov/radon](http://www.epa.gov/radon) for more information.
5. Larger buildings and multifamily properties may share mitigation systems across multiple units or may require multiple soil gas vent systems to accommodate large building footprints. Radon mitigation systems should be installed in multiple locations when building components, such as structural beams, interrupt movement of soil gases to the vent system. See ANSI/AARST CC-1000 for electric metering guidance in shared (collateral) mitigation systems, as well as for maximum nominal sizes of soil gas collection plenums and corresponding pipe sizes.
6. 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 building. 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.
7. EPA recommends the use of radon monitors and/or alarms to inform occupants of potentially elevated levels of radon gas in the home. Radon monitoring devices may be subject to error and/or drift if not calibrated according to manufacturer's instructions. As such, EPA recommends testing and/or monitoring with devices listed by one of the following authorities for having proven to meet minimum quality requirements:
  1. the National Radon Proficiency Program (NRPP) OR
  2. the National Radon Safety Board (NRSB).

## 3. Pest Barriers

### 3.1 Minimize Pathways for Pest Entry

Note: Completion of the [ENERGY STAR requirements](#) satisfies the following Indoor airPLUS requirement:

- ✓ Prescriptive air sealing measures are performed according to Section 4 of the ENERGY STAR Rater Field Checklist appropriate to the project.

#### Additional Indoor airPLUS Requirements:

- In areas classified as “Moderate to Heavy” termite infestation probability as identified by 2018 IRC Figure R301.2 [7]:
  - Foundation walls shall be solid concrete or masonry with a top course of solid block, bond beam, or concrete-filled block.
  - Interior, ground-contact concrete slabs shall be constructed with 6 x 6 in. welded wire fabric, or the equivalent, and concrete walls shall be constructed with reinforcing rods to reduce cracking.
- In areas classified as “Very Heavy” termite infestation probability (as identified by 2018 IRC Figure R301.2[7]) i.e., Alabama, Florida, Georgia, Louisiana, Mississippi, South Carolina, and parts of California and Texas:
  - Foam plastic insulation shall 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 shall be covered with moisture-resistant, pest-proof material (e.g., fiber cement board or galvanized insect screen at the bottom-edge of openings) and shall be kept a minimum of 6 in. above the final grade and landscape bedding materials.
  - Foam plastic insulation applied to the interior side of conditioned crawlspace walls shall be kept a minimum of 3 in. below the sill plate.

**Advisory:** Install a steel mesh barrier termite control system and implement bi-annual inspections for termite nests.

**Advisory:** When sealing gaps larger than 1/4 in., which can provide potential points of entry for rodents, copper or stainless-steel wool is recommended in addition to sealant.

### 3.2 Rodent/Bird Screens for Building Openings

- Provide screens for all operable windows to prevent pest entry.
- Provide corrosion-proof rodent/bird screens (e.g., copper or stainless-steel mesh) for all openings that cannot be fully sealed or caulked.
- Provide a corrosion-proof screen, louver, or grill for all ventilation termination fittings. Openings in the screen/louver/grille must be no smaller than 1/4 in. square and no larger than 1/2 in. in any dimension in accordance with 2018 IRC 303.6.

**Exception:** Dryer ducts must include a weather-resistant termination or louver, but do not require screens.

### 3.3 Multifamily Pest Management

- Multifamily projects must include a pest management plan for the building maintenance company and/or have a documented contract in place with a pest management company upon completion.
- Include sanitary floor drains in common trash/recycling rooms of multifamily buildings.
- In owner/tenant manual, provide guidance for residents on housekeeping practices, refuse removal, and reporting pest problems promptly to building management.

## 4. Heating, Cooling, and Ventilation Systems

### 4.1 Heating and Cooling (HAC) Sizing and Design

*NOTE: This Item addresses design load calculations and system sizing specific to heating and cooling systems. See Items 4.5-4.7 for Indoor airPLUS requirements related to ventilation. Completion of the applicable ENERGY STAR Certified Homes or MFNC HVAC System Designer requirements using Track A (HVAC Grading in accordance with ANSI/RESNET/ACCA Std. 310) or Track B satisfies the following Indoor airPLUS requirements:*

- ✓ In detached one- and two-family homes and townhouses, calculate room-by-room heating and cooling design loads using Unabridged ACCA Manual J v8, 2013 or 2017 ASHRAE Handbook of Fundamentals, or other methodology per the Authority Having Jurisdiction. For all other dwelling units, design loads may be calculated for the dwelling unit rather than room-by-room.
- ✓ For most heating and cooling systems in the home (or building) within the scope of ACCA Manual S, select equipment to accommodate the calculated heating and cooling design loads using ACCA Manual S and ENERGY STAR allowances.

#### Additional Indoor airPLUS Requirements:

- In common spaces of multifamily buildings, design loads associated with heating and cooling shall be determined in accordance with ANSI/ASHRAE/ACCA Standard 183, 2013 or 2017 ASHRAE Handbook of Fundamentals, or other methodology per the Authority Having Jurisdiction.

- For dwelling units where ENERGY STAR does not require heating and cooling design loads to be calculated due to the type of space conditioning system specified, design loads must still be calculated to meet Indoor airPLUS requirements.
- In detached one- and two-family homes and townhouses where ENERGY STAR does not require certain equipment to be selected per ACCA Manual S, systems such as boilers and mini-split / multi-split systems, must be selected per ACCA Manual S to meet Indoor airPLUS requirements.
- For all heating and cooling systems in the home (or building) not within the scope of ACCA Manual S, the output capacity of heating and cooling equipment shall not be greater than that of the smallest available equipment size that exceeds the loads calculated.
- Where heating equipment also provides domestic hot water, calculations must be performed to determine how to size the system to satisfy both loads in accordance with manufacturer's guidance.

#### 4.2 Duct System Design and Installation

*NOTE: This Item applies to all ducted systems providing heating or cooling to the building. See Items 4.5-4.7 for Indoor airPLUS requirements related to ventilation ducts. Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *In detached one- and two-family homes and townhouses, design duct systems according to ACCA Manual D. All other dwelling units may use an equivalent duct design standard.*
- ✓ *Ensure that all dwelling unit duct systems are sealed, with a Rater-measured total duct leakage rate that is no greater than ENERGY STAR allowances.*
- ✓ *Ensure that all common space and shared ducted systems are sealed at all transverse joints, longitudinal seams, and duct wall penetrations with mastic, mastic tape, or internal aerosol-based sealant.*
- ✓ *Where return systems are not fully ducted to the air-handling equipment, ensure the pressure difference between the space containing the air-handling equipment and the adjacent conditioned space meets ENERGY STAR allowances, with the air-handling equipment running on high speed.*

##### Additional Indoor airPLUS Requirements:

- Building framing cavities, such as any framing space (i.e. between wall studs, floor joists, or ceiling joists), shall not be used as ducts or plenums of the forced air supply or return systems.
- Design all common space duct systems to be sized in accordance with the ASHRAE Handbook of Fundamentals or other equivalent computation procedure.
- Dwelling unit ductwork is sealed at transverse joints, longitudinal seams, and duct wall penetrations using mastic systems, internal aerosol-based sealant, or UL-listed tapes used in accordance with their listing. Cloth duct tape is prohibited.
- Duct boots are sealed to finished surfaces (i.e. wall, ceiling, floor) with mastic systems, UL-listed tapes used in accordance with their listing, or an appropriate sealant (e.g. caulk, spray foam). Cloth duct tape is prohibited.

**Advisory:** Where tape is used for duct sealing, EPA recommends that it meet the applicable requirements of UL 181a or UL 181b.

- Cover duct openings throughout all phases of construction to protect from construction debris, and vacuum out duct boots thoroughly prior to installing registers, grilles, and diffusers. When using the HAC system during construction, registers may be covered with filters.

##### Advisories:

- In dwelling units, rather than a transfer grill or louvered door to the space containing the air-handling equipment, a right-sized, fully ducted return is recommended to help ensure adequate return air through the filter to the air-handling equipment.
- Air-handling equipment that move less than 3,000 cfm of air should have a manufacturer's designation for air leakage less than or equal to 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.
- Although not required to meet this specification, collection of a balancing report is recommended for all supply registers and return grilles associated with heating or cooling systems, showing that measured airflows were verified by the contractor to be within the greater of  $\pm 20\%$  or  $\pm 25$  CFM of the design airflow.

#### 4.3 Location of HAC Air-Handling Equipment and Ductwork

- All HAC air-handling equipment and ductwork must be installed within the thermal and air barrier boundary to minimize leakage to outdoors and associated pressure imbalances.

##### Exceptions:

- Up to 10 ft. of total duct length is permitted to be outside of the home/unit's thermal and air barrier boundary.
- Embedded ducts (but not air handlers) may be located in a vented attic if minimum R-8 duct insulation is used, duct leakage to outdoors is measured  $\leq 3$  CFM<sub>25</sub> per 100ft<sup>2</sup> of conditioned floor area, and:

- In Moist (A) and Marine (C) climate zones (per 2018 IECC Figure R301.1), an additional 1.5 in. (min.) of closed-cell spray foam encapsulates the ducts and ductwork is buried under 2 in. (min.) of blown-in insulation; **OR**
- In Dry (B) climate zones (per 2018 IECC Figure R301.1), ductwork is buried under at least 3.5 in. of blown-in insulation.
- Jump ducts which do not directly deliver conditioned air from the HAC unit may be located in attics if all joints, including boot-to-drywall, are sealed per Item 4.2, and the jump duct is fully buried under the attic insulation.
- Ducts and air handlers may be located within an uninsulated crawl space or basement when dehumidification is used to meet the requirement of Item 1.8.
- Make-up air or dedicated outdoor air systems (DOAS) that also provide supplemental heating and cooling.
- Air-handling equipment shall be installed in a location accessible to the occupant or building owner to facilitate cleaning, maintenance, filter replacement, and to provide access to the heating and cooling cores and condensate pans. For attic installation, clear access opening dimensions shall be not less than 20 in. by 30 in., and the passageway to the system shall have continuous solid flooring not less than 24 in. wide. Additionally, equipment in the attic shall be considered accessible only if attic access:
  - Has a permanent stair **OR**
  - Has a pull-down stair or ladder with a minimum capacity of 300 pounds (136 kg); **OR**
  - Is ≤ 9 ft above the floor at the bottom of the hatch and enables arm-length access from a portable ladder without the need to step into the attic; **OR**
  - Leads directly to the equipment from an access door (e.g. kneewall or unfinished mechanical room).
- Do not locate air-handling equipment or ductwork in garages.

**Exception:** This requirement does not apply for multifamily buildings where the system provides heating and/or ventilation for the garage, independent of systems that serve dwelling units.

**Note:** In one- and two-family homes and townhouses with attached garages, ducts and equipment may be located in building framing cavities adjacent to garage walls or ceilings if they are separated from the garage space with a continuous thermal barrier and air barrier. Mechanical rooms with air-handling equipment adjacent to the garage are permitted to have a garage-side access door, so long as the door is insulated, gasketed or weather-stripped, and has self-closing hinges. These allowances are not permitted for dwelling units that are above or adjacent to parking garages in multifamily buildings.

#### 4.4 Pressure-Balanced Bedrooms

*NOTE: Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirement:*

- ✓ *Where ducted systems provide heating and/or cooling to the bedroom, bedrooms shall be pressure-balanced using any combination of transfer grilles, jump ducts, dedicated return ducts, and undercut doors to achieve a Rater-measured pressure differential in accordance with ENERGY STAR allowances and test configuration.*
- ✓ *If certifying dwelling units through ENERGY STAR Certified Homes, bedrooms with a design supply airflow < 150 CFM, shall achieve a Rater-measured pressure differential  $\geq -3$  Pa and  $\leq +3$  Pa with respect to the main body of the dwelling unit when all air handlers are operating.*
- ✓ *In all dwelling units, bedrooms with a design supply airflow  $\geq 150$  CFM, shall achieve a Rater-measured pressure differential  $\geq -5$  Pa and  $\leq +5$  Pa with respect to the main body of the dwelling unit when all air handlers are operating.*

##### **Additional Indoor airPLUS Requirements:**

- If certifying dwelling units through ENERGY STAR MFNC, bedrooms with a design supply airflow < 150 CFM, shall also achieve a Rater-measured pressure differential  $\geq -3$  Pa and  $\leq +3$  Pa with respect to the main body of the dwelling unit when all air handlers are operating.

#### 4.5 Dwelling-Unit Mechanical Ventilation

*NOTE: Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *Provide each dwelling unit with a mechanical ventilation system.*
- ✓ *Test ventilation airflows to ensure they meet minimum ventilation rates, in accordance with ANSI / RESNET / ICC Std. 380.*
- ✓ *In detached one- and two-family homes and townhouses, a readily accessible and labelled mechanical ventilation on/off control shall be supplied.*
- ✓ *Mechanical ventilation fans located within the dwelling unit shall be rated for sound at a maximum of 3 sones if intermittent and 1.0 sone if continuous.*

**Exception:** For MNFC, the maximum is 2 sones, if continuous.

**Exception:** HAC air handlers and remote mounted fans outside the habitable space with at least 4 feet of ductwork between the fan and the intake grille need not meet sound requirements.

- ✓ *Air inlets are visually verified to pull outdoor air directly from outdoors, and not from attic, crawlspace, garage, or adjacent dwelling units.*
- ✓ *Outdoor air inlets are located  $\geq 2$  ft. above grade or roof deck;  $\geq 10$  ft. of stretched-string distance from known contamination sources not exiting the roof, and  $\geq 3$  ft. distance from dryer exhausts and sources exiting the roof.*

#### **Additional Indoor airPLUS Requirements:**

- A balanced ventilation system, with or without heat or energy recovery, shall be designed and installed to provide ventilation air directly to the dwelling unit from the outdoors. Exhaust-only or supply-only ventilation systems are prohibited.

**Note:** The system is considered balanced if the total supply and exhaust airflows measured in the dwelling unit are within 10% or 10 cfm of each other. When calculating the percentage, use the higher airflow as the basis.

- Outdoor air supplied through the HAC air handler is permitted as part of the balanced ventilation system, so long as controls are installed to operate the air handler intermittently & automatically based on a timer and to restrict intake when not in use (e.g., motorized damper) and outdoor airflow can be measured.

- **Note:** Where an HRV/ERV or a powered supply fan is connected directly to the HAC ducting, both systems shall be interlocked to run simultaneously.

**Advisory:** Outdoor air ducts connected to the return side of an air handler are not recommended, but where used as part of the balanced ventilation system, manufacturers' requirements for return air temperature should be met (e.g., most manufacturers recommend a minimum of 60 degrees Fahrenheit air flow across furnace heat exchangers).

- Outdoor air supplied to the dwelling unit shall pass through a filter with a minimum MERV 13 rating. Outdoor air supplied through the filter of the HAC air handler satisfies this requirement.
- The outdoor air intake, filter, fan unit, and heat exchanger (if applicable) are installed in accessible locations to facilitate maintenance and replacement.
- Dwelling-unit mechanical ventilation airflow design rate and run-time shall meet the requirements in Section 4 of ASHRAE 62.2-2013 or later versions.
- Total outdoor air supplied to the dwelling unit shall be measured and documented to meet or exceed the dwelling-unit mechanical ventilation rates required in Section 4 of ASHRAE 62.2-2013, or later versions.

**Note:** Where a rater is unable to measure supply airflow, they may collect and review a report provided by a certified air-balancing contractor.

**Advisory:** Where installing heat or energy recovery ventilation systems, EPA recommends the following:

- Minimize intake duct length.
- Install the room exhaust points high on the walls or in the ceiling.
- Install a trapped condensate drain.

**Advisory:** Where installing powered supply ventilation as part of the balanced ventilation system, EPA recommends the following:

- Locate the supply air grille(s) where it will not deliver unconditioned air near occupants OR supply outdoor air at a minimum temperature of 60°F for a floor diffuser or minimum temperature of 54°F for a high wall or ceiling diffuser.

#### **4.6 Dwelling Unit Bathroom and Kitchen Exhaust**

*NOTE: Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *In each bathroom and kitchen, provide local mechanical exhaust ventilation directly to the outdoors, meeting ASHRAE 62.2-2010 Section 5 requirements, or alternatives as allowed by ENERGY STAR.*
- ✓ *Local mechanical exhaust ventilation for bathrooms that operate continuously shall be rated for sound at a maximum of 2 sones when the exhaust fan is located within the dwelling unit.*

#### **Additional Indoor airPLUS Requirements:**

##### **Bathrooms**

- Intermittent bathroom exhaust fans shall be rated for sound at a maximum of 2 sones at an airflow of 50 cfm.

**Exception:** Remote-mounted fans located  $\geq 4$  ft. from the intake grille and mounted outside bathrooms, toilets, hallways, kitchens, and other habitable spaces.

- Any fans that provide local mechanical exhaust from bathrooms (e.g. ERV/HRV, intermittent bathroom fan, etc.) to meet ASHRAE 62.2 Section 5 requirements, that do not operate continuously at a minimum rate of 20 cfm shall be provided with controls based on humidity or occupancy such that the fan operates when bathroom is occupied and for a minimum of 30 minutes after vacated, or until humidity is less than 60%.

## Kitchens

- Demand-controlled kitchen exhaust (either automated or occupant-controlled) shall be provided at each cooking range by either a:
  - Range hood or appliance-range hood combination, vented to the outdoors, with a minimum Rater-measured exhaust rate of 100 cfm; **OR**
  - Downdraft kitchen exhaust fan, vented to the outdoors, with a minimum Rater-measured exhaust rate of 300 cfm or 5 ACH for enclosed kitchens.

**Note:** In detached one- and two-family homes and townhouses, continuous exhaust may be present in the kitchen, but may not be used in lieu of a demand-controlled exhaust fan.

**Exception:** For units other than detached one- and two-family homes and townhouses, continuous exhaust may be used in lieu of a demand-controlled appliance vented to the outdoors. In such cases, a recirculation range hood with a charcoal filter over the stove is required.

- For all dwelling units where continuous exhaust is present, install a MERV 3 or washable mesh filter in the ventilation grille to trap grease, and do not locate ventilation grilles above or inside a 45 degree angle projected outwards from the cooking equipment element closest to the grille.
- Intermittent kitchen exhaust fans shall be rated for sound at a maximum of 2 sones at an airflow of 100 cfm.
 

**Exception:** Fans with a minimum airflow setting exceeding 400 cfm or remote-mounted fans located  $\geq$  4 ft. from the intake grille and mounted outside bathrooms, toilets, hallways, kitchens, and other habitable spaces.
- Continuous kitchen exhaust fans shall be rated for sound at a maximum of 1 sone at an airflow of 5 ACH based on kitchen volume.

**Exception:** Remote-mounted fans located  $\geq$  4 ft. from the intake grille and mounted outside bathrooms, toilets, hallways, kitchens, and other habitable spaces.

### Advisories:

- Induction cooktops are recommended for reducing particle and NO<sub>2</sub> emissions associated with cooking because of the cooler surface temperatures, which reduces the ultrafine particles emitted from the burn-off of dust, food particles, and detergents used to clean cookware.
- Range hoods and microwave-range hoods are recommended to be HVI or AHAM certified and to have a minimum capture efficiency of 70%, as tested in accordance with ASTM E3087.
- Smart range hood controls are recommended that will activate/deactivate the hood automatically based on operation or using sensors such as temperature, humidity, mixed gas, or a combination thereof.
- While airflow is required to be measured, following the prescriptive duct sizing requirements in Table 5.3 of ASHRAE 62.2-2010 / 2013 / 2016 or the [ENERGY STAR Kitchen Exhaust Guidance](#) is recommended for kitchen exhaust fans.

## 4.7 Common Spaces and Other Ventilation

*NOTE: Completion of the applicable ENERGY STAR MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ Provide ventilation and exhaust in common spaces of multifamily buildings at airflows that are measured to meet or exceed rates required by ASHRAE 62.1-2010.
- ✓ Air inlets are visually verified to pull outdoor air directly from outdoors, and not from attic, crawlspace, garage, or adjacent dwelling units.

### Additional Indoor airPLUS Requirements:

- Outdoor air supplied to common spaces in multifamily buildings shall pass through a filter with a minimum MERV 13 rating. The outdoor air intake, the filter, the fan unit, and the heat exchanger (if applicable) are installed in an accessible location to facilitate maintenance and replacement.
- Vented clothes dryers shall exhaust to the outdoors per the manufacturer's instructions.
- Central vacuum systems shall exhaust to the outdoors at least 10 ft. from ventilation system air inlets.

### Advisories:

- If the dryer exhaust duct exceeds the manufacturer's recommendations in length, diameter, turns, etc., a booster fan certified for safety under UL507 should be installed.
- Vented clothes dryers can exhaust in excess of 200 cfm when in use, causing depressurization. Providing a make-up air system with a tight fitting back-draft damper and automatic switch or timer switch is recommended.

#### 4.8 Particle Filtration for Ducted HAC Serving Dwelling Units and Common Spaces

*NOTE: Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *Ensure that the duct filter slot is accessible to the occupant or building owner.*
- ✓ *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.*
- ✓ *Ensure that all return air and mechanically supplied outdoor air passes through filter prior to conditioning.*

##### **Additional Indoor airPLUS Requirements:**

- For all ducted HAC systems serving dwelling units and common spaces, install filters rated MERV 13 or higher according to ASHRAE 52.2-2017. *NOTE: When reviewing the ENERGY STAR HVAC Design Report, confirm that the "design total external static pressure" in Section 5 includes the MERV 13 filter.*

##### **Advisories:**

- Filter slots are recommended to be a minimum of 2in. in width.
- Air filter installation locations should be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels should be permanently affixed to the air filter installation location and visible to a person replacing the air filter.
- Filters perform best when the filter rack design includes the following features, which are also included in some manufacturers' filter media boxes:
  - Flexible, airtight (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.
- Upon installation of the air-handling unit, include a filter for the remainder of construction activity to help protect the unit and/or coil from construction debris and dust. If temporary filters are utilized during construction, they are not required to meet the MERV rating requirements but must fit the filter slot to prevent bypass. MERV 13 filter(s) should be verified to be in good, clean condition upon final inspection following construction.
 

**Advisory:** To reduce the likelihood of construction dust contaminating the ducts and air handler, limit use of the HAC system during activities with increased dust (e.g. drywall sanding, floor sanding).
- Electronic air cleaners that fall under the scope of UL 867 or CSA Standard C22.2 No. 187:20 (i.e. duct-mounted electrostatic air cleaners, air ionizers, and lamps that emit ultraviolet (UV) radiation between 100 and 280 nm (UVC)) must not exceed ozone emission limits of 0.050 parts per million as specified in the Standards. Such devices are permitted, but are not required, in Indoor airPLUS labeled homes and apartments.
 

**Note:** Ozone is a lung irritant that poses health risks. Even at concentrations below public health standards, ozone reacts with chemicals emitted by common indoor sources such as household cleaning products, air fresheners, deodorizers, certain paints, polishes, wood flooring, carpets, and linoleum. The chemical reactions produce harmful byproducts that may be associated with adverse health effects in some sensitive populations.
- Ozone generators and devices intentionally using ozone to treat or condition air are prohibited.

#### 4.9 Particle Filtration for Non-Ducted HAC Systems Serving Dwelling Units

**Note:** Filtration of particles of indoor origin is currently most practical through high capture filters installed in ducted HAC systems. To be most effective, such systems must operate regularly to circulate air through the filter. Ductless mini-splits generally include a washable filter without a MERV rating, designed primarily to protect the equipment from debris and larger particles. As such, in home/units using only ductless mini-splits, fully hydronic systems, electric resistance heat, or combinations thereof, particle filtration may be more challenging, but can be improved by meeting the following optional recommendations.

**Advisory:** In dwelling units with no ducted HAC system (e.g. homes using only ductless mini-splits, fully hydronic systems, electric resistance heat, or combinations thereof), provide one of the following methods of indoor air filtration to reduce exposure to particles of indoor origin:

- Provide a stand-alone portable air cleaner for each of the two largest living spaces in the home/unit, sized to meet the square footage of each room, based on the verified Clean Air Delivery Rate and room size calculation per ANSI/AHAM Standard AC-1. (Maximum room size for a verified air cleaner is equal to the verified Smoke CADR value x 1.55.) Air cleaners are recommended to be ENERGY STAR certified and meet ozone emission limits of UL 867; **OR**
- Provide a circulation/transfer fan with a MERV 13 filter designed to operate during all occupiable hours and to exchange air between the two largest living spaces (at minimum).

#### 4.10 Humidity Control

- Provide a humidity monitoring device that includes a digital display of indoor temperature and relative humidity (RH) and the ability to record data, either on-board or via a web-based app. This requirement shall be met by either:
  - An RH monitor integrated with a thermostat or other central HAC controls; **OR**

- A standalone digital hygrometer, either permanently mounted or portable.
  - Exception: MFNC projects other than townhouses are not required to include a digital display for either dwelling units or common spaces, so long as remote RH monitoring is achieved by a building management platform.

**Advisory:** The ability to store RH data for a minimum of 30 days is recommended.

- Dwelling units in Moist (A) climate zones 1-4, as defined by 2018 IECC Figure 301.1, shall have equipment designed and installed with sufficient latent capacity to maintain indoor RH at or below 60 percent. This requirement shall be met by either:
  - A ventilating or whole-home dehumidifier plumbed to a discharge drain; **OR**
  - A heating and cooling system equipped with additional controls to operate in dehumidification mode (i.e., variable capacity systems that utilize humidity sensor feedback in the control algorithm).

**Advisories:**

- An additional dehumidification system (in lieu of additional HAC controls) is recommended in “Warm-Humid” climates, as defined by 2018 IECC Figure 301.1.
- EPA recommends maintaining indoor relative humidity (RH) between 40%-60% during most times of the year. In some instances, particularly during winter months, buildings may have extremely lower humidity levels which can create favorable conditions for transmission of respiratory pathogens. In such case, humidification may be helpful to reduce risks of pathogen transmission, improve occupant comfort, and/or to reduce cracking of wood flooring, furniture, or instruments. Humidification is currently neither required nor prohibited to earn the Indoor airPLUS label. In cases where humidification is included in a ducted HAC system, EPA recommends including automatic controls that limit the indoor relative humidity to 40%. If condensation is discovered on windows or ductwork, the humidifier should be adjusted to a lower maximum RH set point. Builders should also provide homebuyers/occupants with instructions from the manufacturer on proper use and maintenance of the humidifier. In home/units with tight building envelopes, supplemental humidification may be unnecessary due to internal latent gains (i.e. cooking, cleaning, bathing) and should be used with caution to avoid excessive moisture vapor, condensation, and mold growth.

#### 4.11 Gas-Phase Air Cleaning Devices

**Note:** Gaseous pollutants include inorganic gases such as combustion gases (e.g., carbon monoxide and nitrogen dioxide), ozone, and organic chemicals that are not attached to particles. Hundreds of different gaseous pollutants have been detected in indoor air. Gas-phase air cleaning technology includes adsorbent media (e.g. activated carbon), chemisorbent media (e.g. media coated or impregnated with reactive compounds), catalytic oxidation, plasma, and intentional ozone generation. Indoor airPLUS currently has no requirements for the inclusion of gas-phase air cleaning equipment. A summary of gas-phase cleaning technology can be found in Residential Air Cleaners – A Technical Summary (EPA, 2018), along with other resources on [Air Cleaners and Air Filters in the Home](#).

- Ozone generators and devices intentionally using ozone to treat or condition air are prohibited.

**Advisory:** When utilized with in-duct HAC systems, gas-phase filters that contain sorbents should generally be located downstream of particle air filters.

#### 4.12 Microbial Disinfection

**Note:** Ultraviolet germicidal irradiation (UVGI) air cleaners are designed to use UV lamps to kill or deactivate microorganisms such as viruses, bacteria, and fungal spores and fragments that are airborne or growing on surfaces (e.g., cooling coils, drain pans, ductwork, filters). UVGI lamps for in-duct airstream irradiation are tested using ANSI/ASHRAE Standard 185.1, and UVGI lamps for in-duct surface irradiation are tested using ANSI/ASHRAE Standard 185.2. Prolonged direct UVGI exposure can destroy vegetative microbial growth. However, typical UVGI air cleaners designed for use in home/units do not deliver sufficient UV doses to effectively kill or deactivate most airborne microorganisms because the exposure period is too short and/or the intensity is too low. Thus, UVGI does not appear to be effective as a sole control device. When UVGI is used, it should be used in addition to—not as a replacement for—conventional particle filtration systems. Indoor airPLUS currently has no requirements for the inclusion of UVGI air cleaners. A summary of UVGI cleaning technology can be found in Residential Air Cleaners – A Technical Summary (EPA, 2018), along with other resources on [Air Cleaners and Air Filters in the Home](#).

**Advisory:** When UVGI lamps are installed in HAC systems, access panels for AHUs should be interlocked with automatic shutoff mechanisms to prevent accidental exposure to UV radiation, and an inspection window that blocks UV energy (e.g., plastic or glass) is recommended to be installed to be able to confirm lamp operation.

## 5. Combustion Pollutant Control

### 5.1 Combustion Appliances

**NOTE:** Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:

- ✓ In all Climate Zones, furnaces, boilers, and water heaters located within the building’s pressure boundary are mechanically drafted or direct-vented. If mechanically drafted, the minimum volume of combustion air required for safe operation by the manufacturer and/or code shall be met or exceeded and make-up air sources must be mechanically closed when the combustion appliance is not in operation.
- ✓ Where following ENERGY STAR MFNC requirements, fireplaces located within the building’s pressure boundary shall be direct-vented and no unvented combustion appliances other than cooking ranges or ovens are located inside the building’s pressure boundary.

- ✓ *Where following ENERGY STAR Certified Homes allowance for naturally drafted fireplaces, Rater has verified the total net rated exhaust flow of the two largest exhaust fans are within maximum allowances when operating at full capacity.*

#### **Additional Indoor airPLUS Requirements:**

- No unvented combustion appliances other than cooking ranges or ovens are located inside the building's pressure boundary (i.e., ENERGY STAR Certified Homes allowances are not permitted). For cooking ranges and ovens, kitchen exhaust requirements per Item 4.6 must be met.
- Naturally drafted furnaces, boilers & water heaters are not permitted within the home's pressure boundary in any Climate Zone (i.e., ENERGY STAR Certified Homes alternatives for Climate Zones 1- 3 are not permitted).

#### **Liquid- or gas-burning appliances**

- Natural gas and propane fireplaces shall have a permanently affixed glass front or gasketed door and be power vented or direct vented in accordance with ANSI Z21.88/CSA 2.33.

#### **Solid fuel burning appliances**

- Meet the following energy efficiency and emissions standards and restrictions for all fireplaces and other solid fuel-burning and space-heating appliances located within the building's pressure boundary:
  - o 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 2018 International Building Code (i.e., fireplaces engineered to store and release substantial portions of heat generated from a rapid burn).
  - o Factory-built wood-burning fireplaces shall meet the certification requirements of UL 127 and shall have a dedicated outside air supply.
    - Advisory:** Factory-built wood burning fireplaces qualified under EPA's wood-burning fireplace program are recommended. See: [www.epa.gov/burnwise/fireplacelist.html](http://www.epa.gov/burnwise/fireplacelist.html)
  - o 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's New Source Performance Standards for new residential wood heaters. See: [www.epa.gov/residential-wood-heaters/final-new-source-performance-standards-residential-wood-heaters](http://www.epa.gov/residential-wood-heaters/final-new-source-performance-standards-residential-wood-heaters).
  - o Pellet stoves shall meet the requirements of ASTM E1509, AND they shall meet the emission requirements of the EPA New Source Performance Standards for new residential wood heaters.
- Where any of the above solid fuel burning appliances are installed within the pressure boundary, an indoor air quality monitoring device shall be installed in the same room. The device shall be capable of monitoring PM<sub>2.5</sub>, and CO<sub>2</sub>, and shall be designed to alert occupants via on-board digital display or web-based app, when one of the following levels are reached:
  - o PM<sub>2.5</sub> – 35 µg/m<sup>3</sup>
  - o CO<sub>2</sub> – 800 ppm

**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 within the "pressure boundary" for the purpose of these requirements.

**Advisory:** IAQ monitoring devices are also recommended, but not required, to be capable of mechanical integration to activate the nearest exhaust fan or dwelling unit ventilation system. In such cases, guidance should be included with the monitoring device that recommends locating the source of the contaminant to determine if backdrafting of combustion appliances needs to be addressed. Also note that IAQ contaminant monitoring systems may require regular maintenance, calibration, and/or replacement of sensor equipment. As such, monitoring and integrated ventilation should be considered an additional tool for increasing occupant awareness and enhancing IAQ protections but should not be considered a substitute for source control methods.

#### **5.2 Carbon Monoxide Alarms**

- All home/units 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 listed and labeled in accordance with UL 2034 or CSA 6.19-01 and placed according to NFPA 72.
- The CO alarm shall contain internal, 10-year non-replaceable batteries.

#### **5.3 Pollutant Control from Smoking for Multifamily Buildings**

- In multifamily buildings with four or more attached dwelling units, to minimize exposure of building occupants, indoor surfaces, and ventilation air distribution systems to pollutants related to smoking and vaping:
  - o Prohibit smoking and vaping in indoor common areas, included but not limited to, corridors, vestibules, stairwells, and community rooms and include such signage in a prominent entryway or lobby, at minimum.
  - o Explicitly communicate the prohibition in the building rental or lease agreements or in condo or co-op association covenants and restrictions and include provisions for enforcement.

- o Locate designated outdoor smoking/vaping areas a minimum of 25 ft. from entries, outdoor air intakes and operable windows.

**Advisory:** Prohibit smoking and vaping of tobacco or other substances throughout the entire building, including within living units, on patios, and balconies. Communicate the prohibition in the building rental or lease agreements or in condo or co-op association covenants and restrictions and include provisions for enforcement.

**Advisory:** Exposure to contaminants is not limited to tobacco smoke. The EPA advises building owner manuals to include information on the dangers of personal-use products, which produce harmful contaminants, such as smoking tobacco and other substances, vaping, and burning candles and incense.

#### 5.4 Pollutant Control through Minimized Infiltration

*NOTE: Completion of the applicable ENERGY STAR MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *Minimize uncontrolled pathways for pollutant transfer between attached dwelling units and common spaces by sealing penetrations in the walls, ceilings, and floors of dwelling units; sealing vertical chases adjacent to dwelling units; and ensuring doors serving as a unit entrance from a corridor/stairwell are made substantially air-tight with door sweep and weather-stripping or equivalent gasket.*
- ✓ *Verify air leakage has been minimized by conducting airtightness testing of dwelling units in accordance with procedures in ANSI/RESNET/ICC Std. 380.*

##### **Additional Indoor airPLUS Requirements:**

- For all attached dwelling units, including townhouses and units in two-family homes, Rater-measured compartmentalization shall be no greater than 0.23 CFM<sub>50</sub> per square foot of dwelling unit enclosure area.
- For all detached homes, Rater-measured airtightness shall be no greater than 3 ACH<sub>50</sub>.

#### 5.5 Attached Garages and Parking Structures

*NOTE: Completion of the applicable ENERGY STAR Certified Homes or MFNC requirements satisfies the following Indoor airPLUS requirements:*

- ✓ *Isolate attached garages from occupied spaces as follows:*
  - o *Air-seal common walls and ceilings between attached garages and occupied spaces before installing insulation.*
  - o *Doors between occupied spaces and attached garages are made substantially air-tight with weather stripping or equivalent gasket.*
  - o *In multifamily buildings, where sampling of compartmentalization tests is permitted, test at least 20% of the dwelling units that are adjacent to the garage.*
- ✓ *In multifamily buildings, where a garage exhaust ventilation system is installed, it is equipped with controls that sense CO and NO<sub>2</sub>, providing a minimum continuous ventilation rate of 0.05 cfm/ft<sup>2</sup> in standby mode, and 0.75 cfm/ft<sup>2</sup> otherwise.*

##### **Additional Indoor airPLUS Requirements:**

- Install an automatic door closer on all connecting doors between occupied spaces and attached garages; **AND**
- In detached one- and two-family homes and townhouses, meet one of the following two requirements:
  - o Verify that the garage-to-house air barrier can maintain a pressure difference of greater than 45 Pa while the home maintains a 50 Pascal pressure difference with respect to the outdoors. All operable garage openings shall be closed during this test; **OR**
  - o Equip the attached garage with an exhaust fan that is vented directly outdoors. The installed fan shall have a minimum rater-verified airflow of 100 cfm, or greater if required by the authority having jurisdiction. The fan shall be wired for continuous operation or with automatic fan controls (e.g., a motion detector) that activate the fan whenever the garage is occupied and operate for at least 1 hour after the garage has been vacated.

##### **Advisories:**

1. EPA recommends installing a garage exhaust fan if the homebuyer is expected to occupy the garage for work or recreational activities over extended periods of time.
2. EPA recommends installing ENERGY STAR certified exhaust fans to reduce energy consumption and sound levels.
3. EPA recommends providing occupants with information in the Buyer Information Kit on the importance of, and methods for, ensuring adequate ventilation in the garage while occupied for extended periods of time.

## 6. Low-Emission Materials

Download [How to Find Indoor airPLUS Compliant Low Emission Products](#), which provides guidance on identifying products that are compliant with these specifications, including the identification of product certification and labeling programs that are acceptable. *[Note: This guidance will be updated when these new specifications are finalized. The current version of this document is applicable to version 1 of the Indoor airPLUS Construction Specifications.]*

**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 concentrations or VOC emissions from any of the product categories addressed in these specifications. The standards and rules referenced in these specifications considered analyses that are designed to reduce human exposure indoors to individual VOCs of potential concern for human health effects, and ambient air emissions, respectively.

### 6.1 Composite Wood

- Structural plywood and oriented strand board (OSB)—use only products that are:
  - Rated as “Exterior” or “Exposure 1”, in compliance with *Voluntary Product Standard PS 1-19, Structural Plywood* **OR** *Voluntary Product Standard PS 2-18, Performance Standard for Wood-Based Structural-Use Panels*.
- Hardwood plywood, particleboard, medium-density fiberboard (MDF) and thin-MDF, and/or products containing these composite wood materials—must comply with [EPA’s Formaldehyde Standards For Composite Wood Products](#), and be certified as Toxic Substances Control Act (TSCA), Title VI compliant.

**Note:** ALL products that are manufactured, sold, or imported into the United States must be compliant with EPA’s Formaldehyde Standards and should therefore be readily accessible in the marketplace. EPA is restating this requirement for clarification between Version 1 and Version 2 of the IAP program requirements. As of June 1, 2018:

- the label on all composite wood panels must include the panel producer’s name, lot number, an EPA-recognized TSCA Title VI Third-Party Certifier number, and a TSCA Title VI compliance statement; and
- the label on finished goods must include the fabricator’s name, the date the finished good was produced (in month/year format), and a TSCA Title VI compliance statement.

**Exception:** The above requirement does not include structural engineered products (i.e. structural composite lumber, glued laminated lumber, prefabricated wood I-joists, or finger-jointed lumber) which are excluded by the EPA formaldehyde rule referenced above.

### 6.2 Interior Paints, Finishes, and Coatings

- At least 90 percent of the interior surface area covered by site-applied paints, finishes, and coatings (including such products with sealing or waterproofing properties) shall use low-VOC products with maximum VOC emission levels in accordance with, and determined using:
  - California Department of Public Health (CDPH), “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2—2017.”
- In addition, such products must also meet VOC content limits for their respective category, and VOC content limits for any colorants added to the final product, as identified in:
  - South Coast Air Quality Management District (SCAQMD), “[Rule 1113 – Architectural Coatings, Amended February 5, 2016](#),” OR
  - California Air Resources Board (CARB), “[Suggested Control Measure for Architectural Coatings, May 2020](#).”

**Note 1:** Some liquid finishing products labeled as “sealants” by the manufacturer may actually be better categorized as a coating or finish. For the purposes of this requirement, Indoor airPLUS references the SCAQMD definition of “coating” in Rule 1113—“a material which is applied to a surface in order to beautify, protect, or provide a barrier to such surface.” A low-emission “sealant”, as required by Indoor airPLUS Item 6.4, is defined by SCAQMD Rule 1168 as “any material with adhesive properties that is designed to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. Sealants include caulks.”

**Note 2:** For the purposes of calculating interior surface area, surfaces including walls, ceilings, floors, and permanently installed cabinets or shelving that receive site-applied coatings should be included in the calculation. Garages are considered to be exterior, and their surfaces shall not be included when calculating interior surface area.

**Note 3:** Interior architectural coatings that are formulated to remove formaldehyde and other aldehydes in indoor air and are tested and labeled in accordance with ISO 16000-23, Indoor air – Part 23, may or may not be compliant with the VOC standards above. EPA has not independently evaluated data on the relative efficacy and long-term impacts of sorptive materials addressed by the ISO 16000-23 standard.

### 6.3 Carpets and Cushions

- At least 90 percent of the interior surface area covered by carpet and carpet cushions must use low-emitting products with maximum VOC emission levels in accordance with, and determined using:
  - CDPH Standard Method V1.2-2017.

### 6.4 Adhesives and Sealants

- At least 90 percent of site-applied interior adhesives and sealants shall be low-VOC products with maximum VOC emission levels in accordance with, and determined using:
  - CDPH Standard Method V1.2-2017.
- In addition, such products must also meet VOC content limits for their respective category, and VOC content limits for any colorants added to the final product, as identified in:
  - SCAQMD, "[Rule 1168 – Adhesives and Sealant Applications, amended October 2017.](#)"

**Note:** Some liquid finishing products labeled as “sealants” by the manufacturer may actually be better categorized as a coating or finish, and thus apply to Section 6.2 (see Section 6.2, Note 1). For the purposes of this requirement, Indoor airPLUS references the SCAQMD definition of “sealant” in Rule 1168—“any material with adhesive properties that is designed to fill, seal, waterproof, or weatherproof gaps or joints between two surfaces. Sealants include caulks.”

### 6.5 Hard Surface Flooring

- At least 90 percent of the interior hard surface flooring materials and underlayments shall be low-VOC products with maximum VOC emission levels in accordance with, and determined using:
  - CDPH Standard Method V1.2-2017.
- Exception: materials that are inherently non-emitting source of VOCs, which include stone, ceramic, metals, glass, concrete, and clay brick.

### 6.6 Gypsum Board

- At least 90 percent of the interior gypsum board and joint compound shall be low-VOC products with maximum VOC emission levels in accordance with, and determined using:
  - CDPH Standard Method V1.2-2017.

### 6.7 Insulation

- At least 90 percent of the insulation materials installed in wall, floor, or ceiling cavities, as well as on the interior surface of foundation walls shall be low-VOC products with maximum VOC emission levels in accordance with, and determined using:
  - CDPH Standard Method V1.2-2017.

#### Exceptions:

- Pipe insulation
- Board insulation installed outside the exterior sheathing

### 6.8 Ventilation after Material Installation

- Ventilate the building with outside air at the highest rate and duration practical during the installation of products that are known sources of contaminants (e.g., composite woods, carpet and padding, adhesives, site-applied finishes) and during the period between finishing and occupancy.

## 7. Occupant Education

### 7.1 Owner and Resident Information Kit

- Provide resident(s), property manager, and/or building owner with information and documentation of the home/unit’s IAQ protections, including:
  - Instruction manuals for all equipment and systems addressed by Indoor airPLUS and ENERGY STAR requirements, including HAC systems and accessories, ventilation systems (both local and whole-dwelling), dehumidifiers, combustion appliances, and radon systems (if installed).
  - Operations and maintenance recommendations, including suggested schedules and sources for the replacement of filters in all ventilation and air handling equipment.
  - An Indoor airPLUS label and certificate for each home/unit, following final verification.

**Advisory:** Provide the homebuyer or building manager with information that addresses the importance of ensuring that manually controlled ventilation options (e.g., bathroom, kitchen, or garage exhaust fans; operable windows, doors, etc.) are used when strong pollutant sources are present, such as when using common household products (e.g., cleaning products, pesticides) and when using the garage for hobbies or other pollutant generating activities.

## Abbreviations & Acronyms

AARST	American Association of Radon Scientists and Technologists	IAQ	Indoor Air Quality
AARST-CC-1000	Soil Gas Control Systems in New Construction of Buildings	ICC	International Code Council
AARST-CCAH	Reducing Radon in New Construction of One & Two Family Dwellings & Townhouses	IECC	International Energy Conservation Code
AARST-MAH	Protocol for Conducting Measurement of Radon and Radon Decay Products in Homes	in.	Inches
AARST-MAMF	Protocol for Conducting Measurement of Radon and Radon Decay Products in Multifamily Buildings	IRC	International Residential Code
AC115	Acceptance Criteria for Waterproof Membranes for Flooring and Shower Lining	ISO	International Organization for Standardization
ACCA	Air Conditioning Contractors of America	MDF	Medium density fiberboard
ACCA Manual D	Residential Duct Design	MERV	Minimum Efficiency Reporting Value defined in ASHRAE 52.2-2017
ACCA Manual J	Residential Load Calculation	MF	Multifamily
ACCA Manual S	Residential Equipment Selection	MFNC	Multifamily New Construction
ACCA Manual T	Air Distribution Basics	mil	Common term to describe plastic sheeting thickness; 1 mil equals 0.001 inches
ACCA Manual Zr	Residential Zoning Systems	min.	Minimum
AHAM	Association of Home Appliance Manufacturers	NFPA	National Fire Protection Association
ANSI	American National Standards Institute	NO <sub>2</sub>	Nitrogen Dioxide
ANSI/ASHRAE 62.1-2010	Ventilation for Acceptable Indoor Air Quality	NRPP	National Radon Proficiency Program
ANSI/ASHRAE 62.2-2013	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings	NRSB	National Radon Safety Board
app	Application	OSB	Oriented strand board
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers	Pa	Pascal
ASTM	American Society for Testing and Materials	pCi/L	Picocuries per liter
CADR	Clean Air Delivery Rate	PHIUS+	Passive House U.S. Certification
CARB	California Air Resources Board	RCRA	Resource Conservation and Recovery Act
CDPH	California Department of Public Health	RH	Relative humidity
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	RRNC	Radon resistant new construction
CFDS	Composite Foundation Drainage System	RZ	Radon zone
cfm	Cubic feet per minute	SCAQMD	South Coast Air Quality Management District
CO	Carbon monoxide	spec.	Specification
EPA	Environmental Protection Agency	sq. ft.	Square foot
ESCH	ENERGY STAR Certified Homes	TSCA	Toxic Substances Control Act
FEMA	Federal Emergency Management Agency	UL	Underwriter Laboratories
fpm	Feet per minute	UV	Ultraviolet light
ft.	Feet	UVA	Near UV: 315nm to 400 nm
HAC	Heating and cooling	UVB	UV: 280 nm to 315 nm
HCO	Home Certification Organization	UVC	UV: 200 nm to 280 nm
HVAC	Heating, ventilating, and air conditioning	UVGI	Ultraviolet germicidal irradiation
		VOC	Volatile Organic Compound
		VOO	Verification Oversight Organization
		w.c.	Water column
		WRB	Water resistive barrier
		XPS	Extruded polystyrene

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- ACCA Man D: ACCA Manual D: Residential Duct Systems. 2015. Air Conditioning Contractors of America.
- ACCA Man J: ACCA Manual J: Residential Load Calculation – 8th Ed. 2015. Air Conditioning Contractors of America.
- ACCA Man S: ACCA Manual S: Residential Equipment Selection – 2<sup>nd</sup> Ed. Air Conditioning Contractors of America.
- ANSI/AARST CCAH 2012: ANSI/AARST Standard: Reducing Radon in New Construction of 1 & 2 Family Dwellings and Townhouses. 2012. American Association of Radon Scientists and Technologists.
- ANSI/AARST CC-1000 2017: ANSI/AARST Standard: Soil Gas Control Systems In New Construction of Buildings. 2017. American National Standards Institute / American Association of Radon Scientists and Technologists. ANSI/HPVA HP-1-2016: American National Standard for Hardwood and Decorative Plywood. 2015. American National Standards Institute / Hardwood Plywood and Veneer Association.
- ANSI/AARST MAH-2019: Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes.
- ANSI/AARST MAMF- 2017: Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily Buildings.
- ANSI/RESNET/ICC Standard 380-2019: Standard for Testing Airtightness of Building, Dwelling Unit, and Sleeping Unit Enclosures; Airtightness of Heating and Cooling Air Distribution Systems; and Airflow of Mechanical Ventilation Systems.
- ANSI/RESNET/ACCA Standard 310: Standard for Grading the Installation of HVAC Systems.
- ANSI/ASHRAE/ACCA Standard 183, 2013 or 2017: Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings.
- ANSI Z21.88/CSA 2.33: ANSI Standard Z21.88-2014/CSA Standard 2.33-2014: Vented Gas Fireplace Heaters. 2014. American National Standards Institute/Canadian Standards Association.
- APA: American Plywood Association provides a voluntary product standard for structural plywood and oriented strand board (OSB). <http://www.apawood.org/plywood>.
- ASHRAE Handbooks: ASHRAE Handbook Series. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
- ASHRAE 52.2: ANSI/ASHRAE Standard 52.2-2007: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. 2007. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.
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- ASTM E1509: ASTM Standard E1509-04: Standard Specification for Room Heaters, Pellet Fuel-Burning Type. 2004. American Society for Testing and Materials.
- ASTM E2600: ASTM Standard E2600-10: Standard Guide for Vapor Encroachment Screening on Property Involved In Real Estate Transactions. 2010. American Society for Testing and Materials.
- ASTM E1602: ASTM Standard E1602-03(2010) e1: Standard Guide for Construction of Solid Fuel Burning Masonry Heaters. 2010. American Society for Testing and Materials.
- CA Section 01350: CDPH Standard Method V1.2-2017; California Section 01350: Special Environmental Requirements Specification: Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Environmental Chambers. 2017. State of California. [https://archive.cdph.ca.gov/programs/IAQ/Documents/CDPH-IAQ\\_StandardMethod\\_V1\\_2\\_2017.pdf](https://archive.cdph.ca.gov/programs/IAQ/Documents/CDPH-IAQ_StandardMethod_V1_2_2017.pdf).
- California Air Resources Board (CARB) Airborne Toxics Control Measure (ATCM) Phase II to Reduce Formaldehyde Emissions from Composite Wood Products. CA Title 17, Section 93120. [www.arb.ca.gov/toxics/compwood/compwood.htm](http://www.arb.ca.gov/toxics/compwood/compwood.htm).
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Known as Superfund, authorizes EPA to respond to releases, or threatened releases of hazardous substances that may endanger public health, welfare, or the environment.
- CSA 6.19-01: CAN/CSA Standard 6.19-01: Residential Carbon Monoxide Alarming Devices. 2006. Canadian Standards Association.
- ENERGY STAR Certified Homes Version 3 Checklists: U.S. Environmental Protection Agency. [http://www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.nh\\_v3\\_guidelines](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_guidelines).
- EPA Building Radon Out (EPA 402-K-01-002): Building Radon Out: A Step-by-Step Guide On How to Build Radon-Resistant Homes. 2001. U.S. Environmental Protection Agency.
- EPA How to Find Indoor airPLUS Compliant Low Emission Products provides guidance on identifying compliant products. <http://www.epa.gov/indoorairplus/indoor-airplus-compliant-low-emission-products>.
- EPA Radon Maps: EPA's Map of Radon Zones. 2008. U.S. Environmental Protection Agency.
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- EPA Vapor Intrusion Primer: Brownfields Technology Primer: Vapor Intrusion Considerations for Redevelopment. 2008. U.S. Environmental Protection Agency.
- Formaldehyde Emission Standards for Composite Wood Products: Toxic Substances Control Act Title VI Formaldehyde Emission Standards for Composite Wood Products. 2016. 40 Code of Federal Regulations, Part 770. <https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0461-0001>.
- IECC: International Energy Conservation Code. 2018. International Code Council, Inc.
- IRC: International Residential Code for One- and Two-Family Dwellings. 2018. International Code Council, Inc.
- NFPA 72: Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment. 2012. National Fire Protection Association.
- PS1-19: Voluntary Product Standard, PS 1-19, Structural Plywood 2019. American Plywood Association.
- PS2-18: Performance Standard for Wood-based Structural-Use Panels. 2018. American Plywood Association.

Resource Conservation and Recovery Act (RCRA): Public law that creates the framework for the proper management of hazardous and non-hazardous solid waste.

UL 127: Standard for Factory-Built Fireplaces. 2011. Underwriters Laboratories, Inc.

UL 181A: Standard for Closure Systems for Use with Rigid Air Ducts. 2008. Underwriters Laboratories, Inc.

UL 181B: Standard for Closure Systems for Use with Flexible Air Ducts and Air Connectors. 2008. Underwriters Laboratories, Inc.

UL 1482: Standard for Solid-Fuel Type Room Heaters. 2011. Underwriters Laboratories, Inc.

UL 2034: Standard for Single and Multiple Station Carbon Monoxide Alarms. 2008. Underwriters Laboratories, Inc.



Climate Zones of the Continental United States

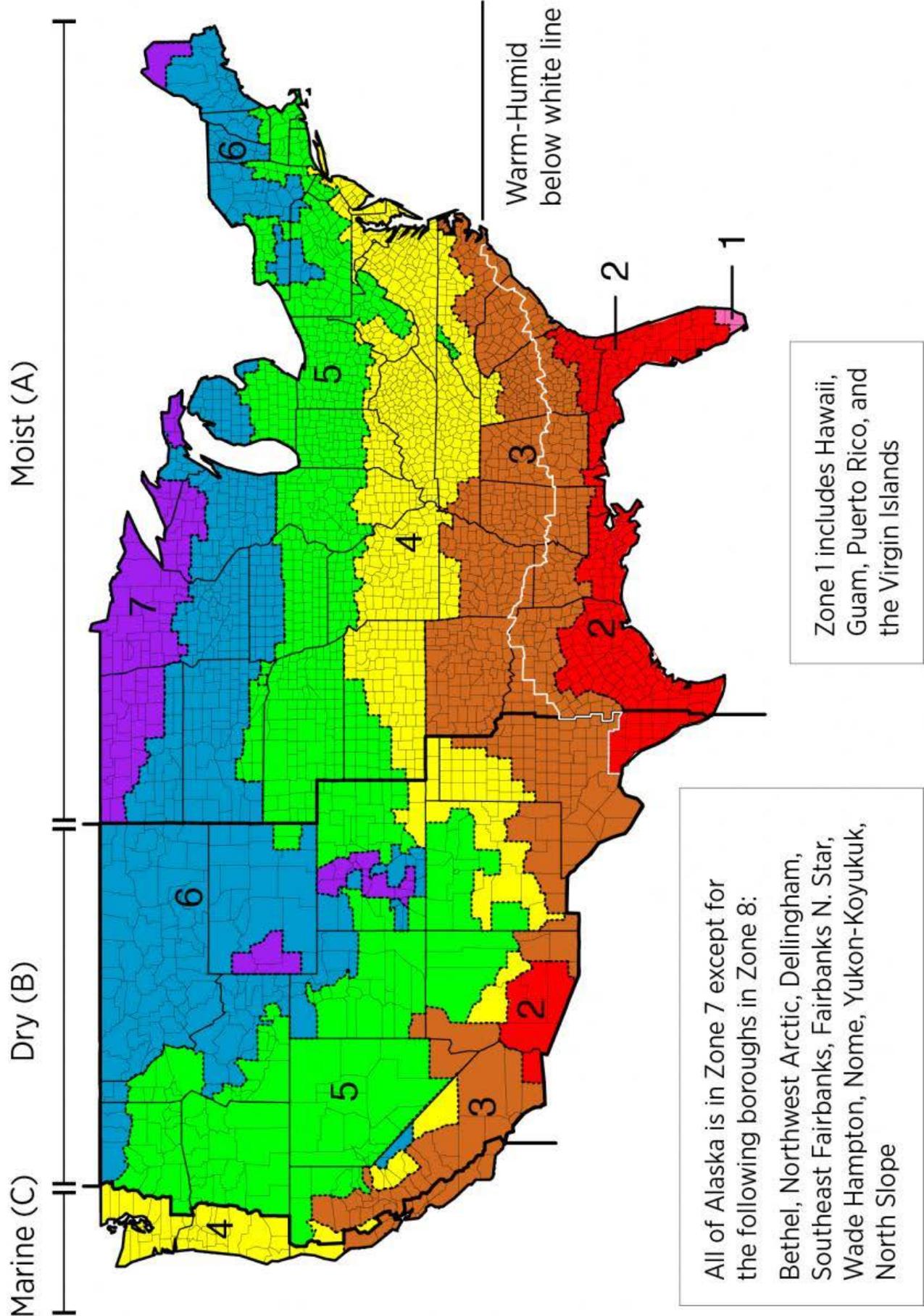


Figure 301.1 Climate Zones of the Continental United States. International Energy Conservation Code



Office of Air and Radiation (6609J)

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Homes with the Indoor airPLUS label are designed for improved indoor air quality compared to homes built to minimum code.

**[www.epa.gov/indoorairplus](http://www.epa.gov/indoorairplus)**