EPA United States Environmental Protection Agency

DRAFT ONLY – February 2023

VERSION 2

Indoor airPLUS Gold

Verification Requirements for Homes and Apartments

Contents

NOTE: Although these measures are designed to help improve IAQ in 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 cleaning practices, regular maintenance of mechanical systems, and the conscientious use of mechanical equipment during unusual events (e.g., power outages, wildfires, etc.) are also important factors that impact IAQ.

Terms To Help Navigate This Document

ADVISORIES provide additional information to be considered or recommendations that are not program requirements. Recommendations in some 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 2021 International Energy Conservation Code (IECC) Climate Zone map (Figure R301.1). 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.

Indoor airPLUS GOLD Version 2 Certification Specifications Verification Checklist

Home/Building Address: _____ **City:** _____ **State:** ____ **Zip Code:** _____

Project Name (Multifamily only): _____ **Number of Units:** _____

☐ **New Construction**

☐ **Gut Rehabilitation**

Climate Zone (0-7): _____ **Moisture Zone (A-C):** _____ **Radon Zone (1-3):** _____

Termite Probability: ☐ **Very Heavy** ☐ **Moderate to Heavy** ☐ **N/A**

ENERGY STAR Prerequisite

Note: Checklist items in italics are ENERGY STAR requirements that are also verified using this checklist. All other ENERGY STAR requirements are documented using the appropriate ENERGY STAR checklists.

	Requirements (Refer to full Indoor airPLUS Construction Specifications for details)	Must Correct	Rater Verified	N/A
Section 1 – Moisture Control				
Water Managed Site and Foundation				
1.1	1.1.1 *Impermeable surfaces sloped ≥ 0.25 in. per ft. away from the building.*	☐	☐	☐
	1.1.2 Exterior drains are free of debris.	☐	☐	☐
	1.1.3 *Newly installed backfill tamped and final grade sloped ≥ 0.5 in. per ft.* *Exception: ☐Swales/drains ☐Professional verified soils ☐Graded after settling*	☐	☐	☐
1.2	1.2.1 Newly constructed foundations, drain tile or CFDS is installed to discharge outside. Exceptions: ☐Professional verified Group I Soils ☐Gut rehab moisture inspection	☐	☐	-
	1.2.2 *Sump cover is mechanically attached and drain discharges ≥ 5 ft. from foundation.* *Exception: ☐Discharge professionally designed or verified Group I Soils*	☐	☐	☐
1.3	1.3.1 In lowest area of basement, install floor drain with trap seal or moisture monitoring system with audible alarm.	☐	☐	☐
1.4	1.4.1 Under newly installed slabs in Moist (A) Zones, aggregate **OR** sand with geotextile matting is installed. Exceptions: ☐Slab-on-grade ☐Professional verified Group I Soils	☐	☐	☐
	1.4.2 *Under newly installed slabs in Moist (A) Zones, Class I vapor retarder in contact with slab above.*	☐	☐	☐
	1.4.3 Crawlspaces without slabs in Moist (A) Zones, Class I vapor retarder installed with penetrations/seams/edges overlapped and sealed.	☐	☐	☐
	1.4.4 Existing slabs in Moist (A) Zones where Items 1.4.1 and 1.4.2 cannot be verified, a continuous/sealed Class I or Class II vapor retarder installed on top of slab. For occupiable spaces, vapor retarder is either a durable floor surface or covered by one.	☐	☐	☐
	1.4.5 Capillary break installed between the foundation wall (or slab) and newly installed sill plates.	☐	☐	☐
	1.4.6 Capillary break installed under or on top of newly installed concrete footers.	☐	☐	☐
1.5	1.5.1 *Newly installed below-grade concrete/masonry walls damp-proofed; wood framed walls waterproofed.* Exception: ☐Gut rehab moisture inspection	☐	☐	☐
1.6	1.6.1 Crawlspaces and basements not vented, and perimeter walls sealed.	☐	☐	☐
	1.6.2 In Moist (A) & Marine (C) Zones active dehumidification in basements or crawlspaces by HAC or supplemental system.	☐	☐	☐
Water-Managed Wall Assemblies				
1.7	1.7.1 *Continuous water-resistive barrier installed behind cladding and a bond-break drainage plane for non-structural masonry assemblies.* Exception: ☐Gut rehab moisture inspection	☐	☐	-
	1.7.2 *Flashing/drainage system at horizontal interruptions and bottom of exterior walls.*	☐	☐	☐
	1.7.3 *Weep holes for masonry veneer and/or weep screed for stucco cladding.*	☐	☐	☐
1.8	1.8.1 *Newly installed windows and doors fully flashed.* Exception: ☐Gut rehab moisture inspection	☐	☐	-
	1.8.2 Windows and doors fully close/latch.	☐	☐	-
Water-Managed Roof Assemblies				
1.9	1.9.1 *Gutter system discharges ≥ 5 ft from foundation, into underground catchment, or sewer/rainwater management system.* *Exceptions: ☐Slab-on-grade ☐Dry (B) Climates ☐Professional verified soils* *☐Rock bed w/ liner ☐Rainwater harvesting systems ☐Continuous rubber membrane*	☐	☐	-
	1.9.2 If utilizing item 1.9.1 exception, extra protection for splash damage included.	☐	☐	☐
	1.9.3 Gutters and downspouts securely installed and clear of debris.	☐	☐	☐
1.10	1.10.1 *Newly installed roof-to-wall intersections and roof penetrations fully flashed.* Exception: ☐Gut rehab moisture inspection	☐	☐	-

	1.10.2 *Newly installed roofing includes kickout flashing at roof-to-wall intersections and roof deck flashing integrated with drainage plane.* Exception: ☐Gut rehab moisture inspection	☐	☐	☐
1.11	1.11.1 *Newly installed roofing includes self-sealing bituminous membrane at valleys and roof penetrations. Exceptions: ☐Dry (B) Climates ☐2021 IRC Section R905.2.8.2 or R905.13*	☐	☐	☐
	1.11.2 Newly installed low sloped or flat roofs are sloped ≥ ¼" per ft. to drains or scuppers and drains are insulated through roof assembly; roof assembly air control layers fully connected to wall air control layers and water control layers overlap.	☐	☐	☐
1.12	1.12.1 Newly installed roofing, CZ 4 and up, include ice barrier over sheathing at eaves and extend from edge of roof line > 2 ft. up. Exception: ☐Gut rehabilitation with R-49 Grade I attic insulation, if vented.	☐	☐	☐
	1.12.2 Between vented attics and living space, gaps and penetrations are sealed where accessible.	☐	☐	☐
1.13	1.13.1 No active leaks or water intrusion in attics and roof assemblies.	☐	☐	-
Interior Moisture Management				
1.14	1.14.1 *Moisture-resistant backing material behind tub and shower enclosures with tile or panel assemblies.*	☐	☐	
1.15	1.15.1 *Drain pan connected to a drain for condensate-producing HVAC equipment and secondary drain system meets 2021 IMC 307.2.3.*	☐	☐	☐
	1.15.2 For tank type hot water heater/storage where leakage could cause damage, drain pan and drain OR detection system with shutoff included.	☐	☐	☐
	1.15.3 Non-vented clothes dryers plumbed to a drain.	☐	☐	☐
1.16	1.16.1 Supply water pipes in exterior building cavities insulated with ≥ R4 pipe wrap. Exceptions: ☐CZ 1-3 in Dry (B) Zone ☐Cavity insulation qualifies as air barrier	☐	☐	-
1.17	1.17.1 Water-resistant flooring installed where moisture or splash damage could occur.	☐	☐	-
1.18	1.18.1 *No Class I vapor retarders on interior side of vapor permeable insulation in below-grade, exterior walls.*	☐	☐	☐
	1.18.2 *In Warm Humid counties, no Class I vapor retarders on the interior side of vapor permeable insulation in above-grade exterior walls.*	☐	☐	☐
1.19	1.19.1 Interior envelope inspection: moisture intrusion and mold are not evident or are otherwise remedied.	☐	☐	-
	1.19.2 Exterior above-grade surfaces verified to be free from degradation or potential moisture intrusion.	☐	☐	-
Section 2 – Radon Testing				
2.1	If radon mitigation is installed, system is: ☐Active ☐Passive ☐N/A (none installed)			
	2.1.1 Upon construction/renovation completion, radon levels tested: ☐Short-term passive sampler ☐CRM Initial tested level (record max result for multifamily) _____ piC/L ☐ Exception: no ground contact locations	☐	☐	-
	2.1.2 Where initial short-term levels tested ≥ 4 piC/L limit: ☐Long-term test <4 piC/L ☐Active system installed Retested Level (record max result for multifamily) _____ piC/L	☐	☐	☐
	2.1.3 Test results documented. If installed, system manual and maintenance guides provided. ☐Exception: no ground contact locations	☐	☐	-
Section 3 – Pests				
3.1	3.1.1 Exterior penetrations and joints sealed.	☐	☐	-
	3.1.2 No signs of active termite infestation or structural damage.	☐	☐	-
	3.1.3 For "moderate to heavy" termite areas, foundation and slab requirements are met.	☐	☐	☐
	3.1.4 For "very heavy" termite areas, foundation and slab requirements are met.	☐	☐	☐
3.2	3.2.1 Corrosion-proof pest screens installed at openings that cannot be fully sealed.	☐	☐	-
	3.2.2 Corrosion-proof screen, louver, or grille for all ventilation termination fittings.	☐	☐	-
	3.2.3 Dryer ducts include weather-resistant termination or louver.	☐	☐	☐
	3.2.4 Screens provided for all operable windows.	☐	☐	☐
3.3	3.3.1 Multifamily buildings include a plan or contract for integrated pest management.	☐	☐	☐
	3.3.2 Multifamily buildings include resident guidance on housekeeping, refuse removal and reporting pest problems in owner/tenant manual.	☐	☐	☐
	3.3.3 Multifamily buildings include sanitary floor drains in common trash/recycling rooms.	☐	☐	☐
3.4	3.4.1 No evidence of pest-contaminated materials within building envelope.	☐	☐	-
Section 4 – HVAC Systems				
Heating and Cooling Design and Inspection				
4.1	4.1.1.1 *Newly installed dwelling-unit heating and cooling (HAC) systems meet design/documentation requirements.*	☐	☐	-
	4.1.1.2 Newly installed common space HAC systems meet design/documentation requirements.	☐	☐	☐
	4.1.2.1 *Newly installed HAC documentation (i.e., start-up, testing) provided to Verifier.*	☐	☐	☐
	4.1.2.2 Existing HAC systems assessed/serviced in accordance with ANSI/ACCA Standard 4.	☐	☐	☐

4.2	4.2.1 Humidity monitoring provided in the main living area of the dwelling unit is: ☐Integrated with HAC controls ☐Standalone hygrometer Exception for MF: ☐RH monitoring by building management platform	☐	☐	-
	4.2.2 Moist (A) CZ 1-4: Equipment installed to maintain RH at or below 60% is: ☐Ventilating or whole-home dehumidifier ☐RH sensor is integrated w/ cooling system(s) Exception for CZ 4A: ☐Humidity data recording, modeling & dehumidification readiness	☐	☐	☐
4.3	4.3.1 *Newly installed dwelling-unit duct systems sized according to:* ☐*ACCA Manual D* ☐*Other (applicable to MF only)*	☐	☐	☐
	4.3.2 Newly installed common space duct systems sized according to ASHRAE Handbook of Fundamentals.	☐	☐	☐
	4.3.3 No building cavities used as air supplies or returns.	☐	☐	☐
	4.3.4 Interior of ducts inspected to be free from debris and contaminants.	☐	☐	☐
	4.3.5 Ducts inspected to be dry, with no evidence of mold and without tears/disconnections.	☐	☐	☐
	4.3.6 Ducts installed outside pressure boundary are sealed at joints, seams, penetrations with compliant material.	☐	☐	☐
	4.3.7 Dwelling unit ducts tested to meet ENERGY STAR total duct leakage requirements. Test Result:_____	☐	☐	☐
	4.3.8 Dwelling unit ducts tested to meet ENERGY STAR duct leakage to outdoor requirements. Test Result:_____	☐	☐	☐
4.4	4.4.1 Air-handling equipment and/or ductwork is not located in garages. Exception for MF: ☐ Systems providing independent garage heating and/or ventilation	☐	☐	☐
	4.4.2 All HAC equipment and ductwork is located within thermal and air barrier boundary. Exceptions (check all that apply): ☐Measured total leakage ≤ 1 CFM25/100sf CFA. ☐Duct lengths are <10 ft. ☐Ducts in vented attic insulated min R-8 and measured leakage to outdoors ≤ 3 CFM25/100sf CFA and encapsulated or buried. ☐2018 IECC Section 403.3.7 or 2021 IECC Section R403.3.2 met. ☐Located in uninsulated crawl or basement meeting item 1.6.2 dehumidification. ☐Rooftop MUA or DOAS.	☐	☐	☐
4.5	4.5.1 Bedrooms with ducted HAC systems are pressure-balanced. Test Result:_____ ☐Moist (A) climate zones 1-3 verified ±3 Pa ☐All other climate zones ±5 Pa	☐	☐	☐
Mechanical Ventilation				
4.6	4.6.1 Balanced mechanical ventilation is installed for each dwelling unit.	☐	☐	-
	4.6.2 Ventilation on/off control is labelled. For one-and two-family buildings and townhouses, on/off control is also readily accessible.	☐	☐	-
	4.6.3 Air inlets verified to pull air directly from outdoors.	☐	☐	-
	4.6.4 Outdoor air inlets ≥ 2 ft. above grade or roof deck; ≥ 3 ft. from dryer exhausts and contamination sources exiting the roof; ≥ 10 ft. from all other contamination source exits.	☐	☐	-
	4.6.5 Ventilation is measured and documented at both supply and exhaust in accordance with ANSI/RESNET/ICC Std. 380 and meets Section 4 of ASHRAE 62.2-2019.	☐	☐	-
	4.6.6.1 Outdoor air passes through a ≥ MERV 13 filter prior to distribution.	☐	☐	-
	4.6.6.2 Outdoor air filters are readily accessible for maintenance.	☐	☐	-
	4.6.7 Ventilation fans rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous. Exception: ☐HAC air handler ☐Remote-mounted fan	☐	☐	-
4.7	4.7.1 Bathroom ventilation exhausts directly to outdoors meeting ASHRAE 62.2-2019 Section 5.	☐	☐	☐
	4.7.2 Bath fans rated ≤ 3 sones if intermittent and ≤ 1 sone if continuous. Exception: ☐Remote-mounted fan	☐	☐	☐
	4.7.3 Bath fans integrated with dwelling-unit ventilation have on/off controls labeled.	☐	☐	☐
	4.7.4 Demand-controlled bath fans include occupancy/humidity sensor.	☐	☐	☐
4.8	4.8.1 Demand-controlled kitchen exhaust is located at the cooktop, vented to outdoors, and Verifier-measured to meet ASHRAE 62.2-2019 Section 5. Multifamily exception: ☐Cooktop is electric, recirculation hood has charcoal filter, continuous exhaust rate met Exception to measurement: ☐Microwave-range hood meets additional requirements	☐	☐	☐
	4.8.2 If continuous exhaust is present in the kitchen, grille meets cooktop separation distance and has MERV 3 or washable filter.	☐	☐	☐
	4.8.3 Continuous kitchen exhaust rated ≤ 1 sone at airflow ≥ 25 cfm and/or demand-controlled kitchen exhaust fan rated ≤ 2 sones at an airflow setting ≥ 100 cfm. Exception: ☐Fans exceeding 400 cfm or remote-mounted fan	☐	☐	-
4.9	4.9.1 Common space ventilation air provided directly from outdoors.	☐	☐	☐
	4.9.2 Common space ventilation and exhaust measured to meet or exceed ASHRAE 62.1-2019.	☐	☐	☐
	4.9.3.1 Common space ventilation outdoor air passes through MERV 13 or higher filter prior to distribution.	☐	☐	☐

	4.9.3.2 Outdoor air intake, filter, fan unit are accessible for maintenance.	☐	☐	☐
4.10	4.10.1 Central vacuum systems exhaust to outdoors and ≥ 10 ft. from ventilation inlets.	☐	☐	☐
	4.10.2 Vented clothes dryers exhaust to outdoors.	☐	☐	☐
Filtration and Air Cleaning				
4.11	4.11.1 Ducted HAC systems include 2" filter slot. Filters rated MERV 13 or higher installed at final inspection. Exception for existing HAC systems in dwelling units: ☐MERV 11 plus portable air cleaners	☐	☐	☐
	4.11.2 HAC return air filters are accessible for cleaning and/or replacement.	☐	☐	☐
	4.11.3 Filter access panels are gasketed and/or sealed.	☐	☐	☐
	4.11.4 All return air and mechanically supplied outdoor air pass through the filter.	☐	☐	☐
	4.11.5 Electronic air cleaners do not exceed ozone emission limits of 0.005 ppm.	☐	☐	☐
	4.11.6 Ozone generators or devices intentionally using ozone are not installed.	☐	☐	-
4.12	4.12.1 One of the following filtration methods provided for homes/apts. with no ducted HAC system: ☐MERV 13 or higher ☐Portable air cleaners ☐Transfer fan w/ MERV 13 or higher	☐	☐	☐
4.13	4.13.1 Where gas-phase air cleaning devices are installed, ozone is not intentionally used.	☐	☐	☐
4.14	4.14.1 Where provided, UVGI or other electronic air cleaners (e.g., plasma generators, PCOs, etc.) must not exceed ozone emissions of 0.005ppm.	☐	☐	☐
Section 5 –Pollutant Control				
5.1	5.1.1 Combustion furnaces, boilers, water heaters mechanically drafted or direct-vented.	☐	☐	☐
	5.1.2 Fireplaces mechanically drafted or direct-vented.	☐	☐	☐
	5.1.2.1 Liquid or gas-burning fireplaces have tempered glass front or gasketed door.	☐	☐	☐
	5.1.3 No unvented combustion appliances other than cooktops/ranges/ovens.	☐	☐	
	5.1.4 Existing chimneys and flues pass professional Level II inspection per NFPA 211.	☐	☐	☐
	5.1.5 Solid fuel-burning appliances meet the following requirements (check where applicable): ☐site-built masonry fireplaces sealed to prevent use or retrofitted ☐factory-built wood burning fireplaces have dedicated outdoor air & meet UL 127 ☐wood stoves/inserts meet UL 1482 Section 3.8 and EPA Performance Standards ☐pellet stoves meet ASTM E1509 and EPA Performance Standards	☐	☐	☐
5.2	5.2.1 CO alarms installed in all dwelling units and located as follows: 5.2.1.1 Where fuel burning appliances permanently installed; and 5.2.1.2 On every habitable level; and 5.2.1.3 Within 21' of a sleeping room.	☐	☐	-
	5.2.2 CO alarms and detectors listed and labeled in accordance with required standards.	☐	☐	-
	5.2.3 CO alarms are hardwired with battery backup.	☐	☐	-
	5.2.4 CO alarm sounds when the test button is pushed.	☐	☐	-
	5.2.5 CO alarms are protected from dust, paint, and contaminants during construction.	☐	☐	-
5.3	5.3.1 Occupant provided with EPA's brochure or resource guide on secondhand smoke	☐	☐	-
	5.3.2 For multifamily buildings, smoking/vaping prohibition is posted in common areas and communicated in lease agreement.	☐	☐	☐
	5.3.3 For multifamily buildings, where provided, designated outdoor smoking/vaping areas located a minimum of 25 ft from entries, outdoor air intakes, and operable windows.	☐	☐	☐
5.4	5.4.1 Airtightness testing in accordance with ANSI/RESNET/ICC Std. 380 is met: ☐Detached homes > 1,000 ft², ≤ 3 ACH50 ☐All other homes/units ≤ 0.23 CFM50/sf encl. Test Result:_____	☐	☐	-
5.5	5.5.1 *Walls/ceilings between garages and occupied spaces are air-sealed and doors are gasketed/weather-stripped.* In addition, automatic door closers installed.	☐	☐	☐
	5.5.2 Detached one- and two- family homes and townhouses with attached garages: ☐Pressure test conducted to verify effectiveness of garage-to-house air barrier; OR ☐Exhaust fan installed in garage and Verifier-measured airflow ≥ 100 cfm	☐	☐	☐
	5.5.3 *For multifamily buildings, shared parking garage exhaust systems with CO/NO2 controls and continuous ventilation rate ≥ 0.05 cfm/ft2 in standby and ≥ 0.75 cfm/ft2 otherwise.*	☐	☐	☐
5.6	5.6.1 No combustible liquid or gas fuels stored within the building's thermal/pressure boundary.	☐	☐	-
	5.6.2 Supplemental portable combustion equipment not operated or stored within the building's thermal/pressure boundary.	☐	☐	-
Section 6 – Building Materials (newly installed)				
6.1	6.1.1 Paints, finishes, and coatings meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐
	6.1.2 Paints, finishes, and coatings meet SCAQMD Rule 1113 OR CARB VOC content limits.	☐	☐	☐
6.2	6.2.1 Carpet and carpet cushions meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐
6.3	6.3.1 Adhesives and sealants meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐
	6.3.2 Adhesives and sealants meet SCAQMD Rule 1168 VOC content limits.	☐	☐	☐
6.4	6.4.1 Hard surface flooring and underlayment meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐

6.5	6.5.1 Interior gypsum board and joint compound meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐
6.6	6.6.1 Insulation materials meet VOC emission limits in CDPH Standard Method V1.2-2017.	☐	☐	☐
6.7	6.7.1 Gut rehabs: Visual inspection for Asbestos Containing Material (ACM): ☐ACM not found ☐ACM inspected and removed/encapsulated by qualified Asbestos Inspector, with documentation collected	☐	☐	☐
6.8	6.8.1 Buildings built prior to 1978 assessed for lead-based paint, with documentation collected.	☐	☐	☐
	6.8.2 If lead-based paint identified, risk assessment conducted by certified professional and mitigated as required.	☐	☐	☐
Section 7 – Operation and Maintenance				
7.1	7.1.1 Instruction manuals provided for all specified appliances and systems.	☐	☐	-
	7.1.2 Owner-occupied units: O&M recommendations and filter change schedule provided.	☐	☐	☐

Verifier Organization		**Home Certification Organization**			
Verifier Name		**Pre-Insulation Inspection Date**		**Initials**	
Verifier Name		**Final Inspection Date**		**Initials**	

Guidance for Completing the Indoor airPLUS Verification Checklist

1. Only homes or apartments certified under the ENERGY STAR Single Family New Homes or Multifamily New Construction program and verified to comply with these specifications can earn the Indoor airPLUS Gold label. See the Indoor airPLUS National Program Requirements for full descriptions of the certification process; program eligibility; and partnership, training, and credentialing requirements. Indoor airPLUS requirements are not intended to supersede where local jurisdictions may have more stringent requirements (e.g., duct leakage allowances). Verification is not complete until this checklist is completed in full and signed.
2. Check one box per line. Check "N/A" for specifications that do not apply for specific conditions (e.g., climate, building type) according to the exceptions described in the Indoor airPLUS requirements. Items may be verified visually by the Verifier on-site during construction/rehabilitation, by reviewing photographs taken during construction/rehabilitation, by reviewing material or equipment documentation, or through equivalent methods as appropriate. Requirements that refer to existing building elements only apply to features that exist as part of a gut rehabilitation.
3. The Verifier who conducted the verification, or a responsible party from the Verifier's company, must sign the completed checklist. If a quality assurance review indicates that items have not been successfully completed, the Verifier will be responsible for facilitating corrective action.
4. The Verifier shall retain the rating documentation, all required ENERGY STAR Single Family New Homes or Multifamily New Construction documentation, and the Indoor airPLUS Verification Checklist for the home or multifamily building for a minimum of 10 years from final verification. The Verifier shall coordinate with their HCO/Designee and/or builder/owner to provide an Indoor airPLUS label and certificate for each qualified home/unit.
5. Verifiers who operate under an approved sampling protocol are permitted to verify any checklist item using an HCO-approved sampling protocol for Indoor airPLUS homes/units.

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

Indoor airPLUS Gold Certification Specifications Version 2

ENERGY STAR certification is a pre-requisite for a residence to achieve Indoor airPLUS Gold Certification. ENERGY STAR checklist items that satisfy Indoor airPLUS requirements are italicized throughout. Please refer to the ENERGY STAR Residential New Construction Program website for more information and the full description of the requirements.

1. Moisture Control

Water-Managed Site and Foundation

1.1 Site Drainage

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

1.1.1 *Impermeable surfaces (e.g., patio, porch, or plaza slabs; sidewalks; ramps; driveways) are sloped ≥ 0.25 in. per ft. away from the building to the edge of surface, to a swale or drain, or a minimum of 10 ft., whichever is less.*

1.1.2 Exterior drains shall be free of debris.

1.1.3 *Final grade sloped* 0.5 in. per ft *away from the building* either a minimum of 10 ft or to a swale or drain. *Newly installed or disturbed backfill has been tamped.*

Exceptions:

E1.1.3 *Tamping of backfill is not required if either:*

i. *Proper drainage can be achieved using non-settling compact soils, as determined by a certified hydrologist, soil scientist, or Professional Engineer;* ***OR***

ii. *The builder has scheduled a site visit to provide in-fill and final grading after settling has occurred.*

1.2 Foundation Drainage

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

1.2.1 For newly constructed foundations, *drain tile or Composite Foundation Drainage System (CFDS) is installed at basement and crawlspace walls and sloped to discharge to outside grade (daylight) or to a sump pump, sewer, or runoff management system.*

Notes:

N1.2.1a *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 ≥ 6 in. of ½ to ¾ 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.*

N1.2.1b *For CFDS: the system must include a soil strip drain or another ICC-ES evaluated perimeter drainage system to be eligible for use.*

Exceptions:

E1.2.1 *A foundation drainage system is not required when a certified hydrologist, soil scientist, or Professional Engineer has determined that the foundation rests on Group I Soils (i.e., well-drained ground or sand-gravel mixtures), as defined by 2021 IRC Table R405.1.*

E1.2.1b In a building undergoing gut-rehabilitation, where a foundation drain cannot be verified, an interior moisture management inspection can be used in lieu of drainage system verification. See Item 1.19 for inspection criteria. Where an interior drain tile is installed to mitigate moisture intrusion in an existing foundation, a channel to the exterior through the footing is not required.

1.2.2 *Where a sump pit is installed, covers shall be mechanically attached with full gasket seal or equivalent. Sump drainage shall be discharged a minimum of 5 ft. from the foundation.*

Exception:

E1.2.2 Discharging a minimum of 5 ft. from the foundation is not required when a certified hydrologist, soil scientist, or Professional Engineer has designed an alternative management system or determined that the foundation rests on Group I Soils.

Advisories:

A1.2.2a The point of discharge should be as far away from the building's foundation as practically feasible and discharge piping should be installed below grade or otherwise protected.

A1.2.2b In CZ 4 and higher for wet sites with deeper foundations, a freeze guard or a similar fitting with integral openings is recommended where the pipe exits.

1.3 Bulk Water Prevention

1.3.1 In buildings with a basement or crawlspace, a floor drain or moisture monitoring system is installed in the lowest floor area to mitigate risk from internal bulk water events. Floor drains shall include trap seal protection according to 2021 IRC P3201.2.1. 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. A moisture monitoring system shall emit an audible alarm and/or send notifications via a web-based app when water is detected.

Advisories:

A1.3a 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.).

A1.3b Any trapped drains, other than floor drains, without trap seal protection that do not receive regular water input should be filled with mineral oil to reduce the potential for evaporation.

A1.3c Moisture monitoring systems, where installed, should have the ability to shut off water supply in the event of a plumbing malfunction.

1.4 Capillary Break and Vapor Retarder

1.4.1 Under newly installed concrete slabs in Moist (A) Zones, as defined by 2021 IECC Figure R301.1, a capillary break is installed by using either:

1.4.1.1 A 4 in. (min.) layer of ½ in. diameter or greater clean aggregate; **OR**

1.4.1.2 Continuous geotextile drainage matting installed according to the manufacturer's instructions.

Exceptions:

E1.4.1a Slab-on-grade foundations.

E1.4.1b Buildings built on free-draining soils are recommended, but not required, to meet the above capillary break requirements. Free-draining soils are identified as Group I (Table R405.1, 2021 IRC) by a certified hydrologist, soil scientist, or Professional Engineer through a site visit.

1.4.2 *Under newly installed concrete slabs in Moist (A) Zones, a Class I vapor retarder (as defined by the 2021 IRC) is installed in direct contact with the concrete slab above by overlapping seams and/or sealing joints and penetrations.*

1.4.3 For crawlspaces without concrete slabs in Moist (A) Zones, a Class I vapor retarder is installed 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).

Advisories:

A1.4.3a Where crawlspace floors are not covered with a concrete slab, a vapor barrier rated Class A in accordance with ASTM E1745 is recommended.

A1.4.3b Prior to installing the vapor retarder, prepare the ground by leveling and removing obstructions capable of causing tears or punctures.

1.4.4 For existing slabs located in Moist (A) Zones, where the presence of a capillary break (Item 1.4.1) and Class I vapor retarder (Item 1.4.2) cannot be visually verified, a continuous and sealed Class I or Class II vapor retarder is 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 the bottom plates in walls). In addition, for existing slabs in occupiable space, the vapor retarder shall also be a durable floor surface or covered by a durable floor surface.

Exception:

E1.4.4 Garages and utility areas are not subject to these requirements for existing slabs.

1.4.5 A continuous capillary break is installed between the foundation wall (or slab) and newly installed sill plates.

1.4.6 Capillary break installed under or on top of all newly installed concrete footers using either 6 mil (or thicker) polyethylene sheeting, bituminous membrane, or liquid waterproofing.

Note:

N1.4.5 A capillary break can be achieved at the footer by encapsulating the entire stem wall with bituminous membrane wrapping from the exterior, over the sill, and down the interior of the stem wall.

1.5 Damp-Proofing and Waterproofing Below-Grade Exterior Walls

Intro: *Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:*

1.5.1 *For the below-grade exterior of newly installed concrete and/or masonry walls, finish with damp-proofing coating. For the below-grade exterior of newly installed wood framed walls, finish with polyethylene and adhesive or other equivalent waterproofing.*

Exception:

E1.5.1 For below-grade walls in buildings undergoing gut rehabilitation, interior surfaces of foundation walls are inspected and verified to have no signs of active moisture intrusion. See Item 1.19 for inspection criteria.

1.6 Basement and Crawlspace Conditioning

1.6.1 Seal crawlspace and basement perimeter walls to prevent outside air infiltration. Vented crawlspaces and basements are not permitted.

Note:

N1.6.1 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.

1.6.2 In Moist (A) and Marine (C) Zones, as defined by 2021 IECC Figure R301.1, where a basement or crawlspace is not served by a Heating and Cooling (HAC) system with humidity controls as outlined in Item 4.2.2, provide supplemental active dehumidification, sized for the total volume of the basement and/or crawlspace according to manufacturer's recommendations. Dehumidifier shall be programmed to maintain relative humidity (RH) at or below 60 percent and shall be continuously drained to the outside or to a sump pump.

Advisories:

A1.6a To avoid humidity issues during "swing seasons" or low-load periods where space conditioning systems may not be operating regularly, EPA recommends an active dehumidification system (in lieu of or in addition to the HAC system) in crawlspaces and basements.

A1.6b Where whole-home dehumidification or HAC systems are utilized to condition below-grade spaces, EPA recommends locating the humidity sensor in the basement or crawlspace.

A1.6c 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

1.7 Drainage Plane and Flashing

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

1.7.1 *A continuous Water-Resistive Barrier (WRB) is installed behind exterior wall cladding that overlaps flashing and is fully sealed at all penetrations. Behind all stucco and non-structural masonry cladding wall assemblies, an additional bond-break drainage plane is provided between WRB and cladding.*

Exception:

E1.7.1 In a building undergoing gut-rehabilitation where the WRB and drainage plane cannot be verified, an interior moisture management inspection can be used in lieu of WRB verification. See Item 1.19 for inspection criteria.

1.7.2 *Flashing or an equivalent drainage mechanism is installed at all horizontal interruptions and the bottom of exterior walls to direct water away from the WRB and foundation.*

1.7.3 *Weep holes for masonry veneer and weep screed for stucco cladding systems are included, per manufacturer specifications.*

Advisories:

A1.7a Liquid or fluid applied membranes and integrated sheathing systems with sealed/taped seams should be applied and/or sealed on clean surfaces and according to manufacturer's instructions to perform as a WRB.

A1.7b Rainscreen assemblies with a minimum 1/2 in. air space or drainage mat are recommended between the cladding and drainage plane.

1.8 Exterior Window and Door Openings

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

1.8.1 *Newly installed windows and doors must be fully flashed. Apply a formed pan, flexible tape, or liquid applied pan flashing from the interior edge of sill framing, terminating over the front edge of framing and WRB and covering 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.*

Exception:

E1.8.1 In a building undergoing gut-rehabilitation where flashing cannot be verified, an interior moisture management inspection can be used in lieu of flashing verification. Where moisture intrusion is evident around fenestrations, the fenestration must be removed and flashed as newly installed per 1.8.1. See Item 1.19 for inspection criteria.

Advisories:

A1.8.1a Where flexible tape or liquid applied pan flashing is utilized to form a pan, a pitched sill is recommended.

A1.8.1b When selecting new fenestration, the ANSI/NFRC 500-2020 Condensation Index (CI) should be used to limit surface condensation based on the local design temperature, Relative Humidity (RH), and the dew point.

1.8.2 Windows and doors must fully close and latch.

Water-Managed Roof Assemblies

1.9 Gutters, Downspouts, and Roof Water Drainage

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

1.9.1 *Direct roof water away from the building using gutters, downspouts, and lateral piping or other non-porous diverters that discharge either:*

1.9.1.1 *A minimum of 5 ft. from foundation on a sloping finish grade,* ***OR***

1.9.1.2 *Into an underground catchment system not connected to the foundation drain system that discharges water ≥ 10 ft. from foundation,* ***OR***

1.9.1.3 *Into an approved sewer or rainwater management system.*

Exceptions:

E1.9.1a *Buildings with slab-on-grade foundations;*

E1.9.1b *Buildings in Dry (B) climates as shown in 2021 IECC Figure R301.1 and Table R301.1;*

E1.9.1c *Building sites with no expansive or collapsible soils, as determined by a certified hydrologist, soil scientist, or Professional Engineer during site preparation;*

E1.9.1d *A roof design that deposits rainwater to a grade-level rock bed with a waterproof liner and a lateral drain pipe that meets the above discharge requirements;*

E1.9.1e *A rainwater harvesting system that drains overflow to meet the above discharge requirements;*

E1.9.1f *A continuous rubber membrane (e.g., EPDM) aligned with the foundation wall from final grade to ≥ 8 in. below grade and sloping ≥ 0.5 in. per ft. away from the home for at least 5 ft., with Group I Soils (as defined by 2021 IRC Table R405.1), covering the membrane to within 3 in. of final grade.*

1.9.2 Buildings meeting a gutter installation exception from above, must provide extra protection for water splash damage using one of the following methods:

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

1.9.2.2 Provide a drip line at eaves that is horizontally 16 in. away from the edge of the foundation wall; **OR**

1.9.2.3 Use cladding materials that are decay and rot resistant and can tolerate regular wetting extending at least 16 in. above final grade; **OR**

1.9.2.4 Where wood siding is used without any of the above protections, a rainscreen assembly with a minimum ½ in. air space between the cladding and drainage plane is required.

1.9.3 Gutters and downspouts, where provided, are verified to be securely installed and substantially clear of debris.

1.10 Roof to Wall Intersections and Roof Penetrations

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

1.10.1 *Fully flash all newly installed roof-to-wall intersections and newly installed roof penetrations using step flashing for conventional roofs or continuous flashing for metal and rubber membrane roofs.*

1.10.2 *Install kickout flashing at the low end of newly installed 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.*

Exception:

E1.10 In a building undergoing gut-rehabilitation where flashing cannot be verified, an interior moisture management inspection can be used in lieu of flashing verification. Where moisture intrusion is evident at roof-to-wall intersections and roof penetrations, the roofing material must be removed and flashed as newly installed per 1.10.1 and/or 1.10.2, as necessary. See Item 1.19 for inspection criteria.

1.11 Roof Valleys and Decking

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

1.11.1 *Newly installed roofing includes self-sealing bituminous membrane or the equivalent at all valleys and roof decking penetrations for durability at potential failure points.*

Exceptions:

E1.11.1a *Not required in Dry (B) climates as shown in 2021 IECC Figure R301.1 and Table R301.1.*

E1.11.1b *Any option in 2021 IRC Sections R905.2.8.2 or R905.13 are permitted.*

1.11.2 Newly installed low sloped or flat roofs (<2:12 pitch) shall meet the following criteria:

1.11.2.1 Sloped to drains or scuppers at a minimum ¼ in. per ft.;

1.11.2.2 Roof drains insulated through roof assembly to reduce the possibility of condensation;

Advisory:

A1.11.2.2 EPA recommends installing 3 in. of vapor impermeable insulation (i.e., ccSPF) for a length (vertical and/or horizontal) of 3 ft. from the drain penetration at the roof deck.

1.11.2.3 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;

1.11.2.4 Materials that form the water control layer must overlap each other in shingle fashion or be sealed in a watertight manner.

Exception:

E1.11 In a building undergoing gut-rehabilitation, where components of the roofing assembly cannot be verified from above, an interior moisture management inspection can be performed. Where moisture intrusion is evident through the building envelope, the affected roofing material(s) or component(s) must be removed and treated as newly installed per the applicable requirements of Item 1.11, as necessary. See Item 1.19 for interior inspection criteria.

1.12 Ice Dam Prevention

1.12.1 In 2021 IECC Climate Zones 4 & higher, for newly installed roofing, include ice barrier over the sheathing at eaves to provide protection from ice dams. Extend a self-sealing bituminous membrane (or equivalent) from the edge of the roof line to > 2 ft. up roof deck from the interior plane of the exterior wall.

Exception:

E1.12.1 For gut rehabilitations in 2021 IECC Climate Zones 4 & higher, where ice flashing per Item 1.12.1 cannot be verified under existing roofing in homes with vented attics, install insulation to meet or exceed R-49 (or equivalent U-factor). Ensure Grade I insulation per ANSI/RESNET/ICC 301-2022 installed throughout and terminates at the interior face of the exterior wall below.

Advisory:

A1.12.1a EPA recommends installing 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.

A1.12.1b For attics vented at the eaves, wind baffles are installed in every rafter cavity that extend up the roofline from the outside edge of the exterior wall and terminate inside the attic above the level of the insulation. Either the baffle, or other blocking type, shall fully block the vertical edge of the insulation between the width of the bay from the vented eave to prevent wind washing.

1.12.2 Where accessible, verify gaps and penetrations have been substantially sealed between vented attics and the living space (e.g., tops of balloon-framed cavities, chases, wiring and plumbing penetrations, top plates, etc.).

1.13 Interior Roof Deck Inspection

1.13.1 In all accessible attic and roof assemblies, visually verify no active water leaks, as evidenced from active water intrusion or staining on roof decking and/or ceiling materials. Any active water leaks must be repaired.

Note:

N1.13.1 Structural materials with staining from former leaks are permitted to remain uncoated/untreated, so long as they are not in the occupiable spaces of the building. Roof sheathing and materials with visible water stains within an unoccupied attic do not need to be replaced unless the structural integrity of the material has been compromised from water damage. Refer to Item 1.19 for inspection/remediation criteria for mold and fungal growth.

Interior Moisture Management

1.14 Moisture-Resistant Backing Materials

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

1.14.1 *Where installed, backers for wall tile and wall panels in tub and shower enclosures shall be cement board complying with ASTM C1288 or ISO 8336, Category C, or equivalent moisture-resistant material. Paper-faced backerboard shall not be used.*

Note:

N1.14.1 *In addition to fiber-cement board,* fiber-mat reinforced cementitious panels complying with ASTM C1325; glass mat water-resistant gypsum panels complying with ASTM C1178; water-resistant fiber-reinforced gypsum panels complying with Section 6 of ASTM C1278; or *materials that have been evaluated by ICC-ES per AC 115 may also be used to meet this requirement. 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* has received a rating of 10 when tested in accordance with *ASTM D3273.*

1.15 Appliance Drainage

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

1.15.1 *For each condensate-producing HVAC component, a 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.* Where damage to building materials could occur as a result of overflow from the equipment, a secondary drain system is included meeting one of the auxiliary protection methods outlined by 2021 IMC section 307.2.3.

1.15.2 Tank-type water heaters and hot water storage tanks located where water leakage from the tank could cause damage, shall be installed:

1.15.2.1 Over a corrosion-resistant drain pan that drains to a conspicuous point of disposal; **OR**

1.15.2.2 On an impervious surface with a floor drain within 2’ and moisture proof material at least 6” high installed around the room perimeter; **OR**

1.15.2.2 With a leak detection system including an automatic water supply shutoff installed at the water tank.

1.15.3 Non-vented (condensing or heat pump) clothes dryers shall be plumbed to a drain according to the manufacturer’s instructions.

1.16 Water Supply Pipes

1.16.1 Insulate hot and cold water supply pipes in exterior building cavities with minimum R4 pipe wrap.

For water supply pipes in exterior building cavities that are not accessible in gut rehabilitations, see also Item 1.19 - Materials with Signs of Water Damage or Mold.

Exceptions:

E1.16.1a Climate Zones 1-3 located in Dry (B) Zones, as defined by 2021 IECC Figure R301.1.

E1.16.1b When cavity insulation qualifies as an air barrier and pipes are located within the interior 50% of the wall cavity.

Advisories:

A1.16.1a Pipes should be installed as close as possible to conditioned space while maintaining Grade I insulation installation to reduce risk of freezing and/or condensation.

A1.16.1b Insulate hot and cold water supply pipes in exterior building cavities with minimum R4 pipe wrap in all climate zones.

1.17 Water-Resistant Flooring

1.17.1 In areas where moisture or splash damage could occur (e.g., 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:

N1.17.1 Wood flooring, either pre-finished or site-finished, or sub-flooring rated APA “Exposure 1” or “Exterior” 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.

1.18 Class I Vapor Retarders

Intro: *Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirement:*

1.18.1 *Class I vapor retarders not installed on the interior side of vapor permeable insulation in below-grade exterior walls.*

1.18.2 *In Warm Humid counties, as defined by 2021 IECC Section R301.2, Class I vapor retarders are not installed on the interior side of vapor permeable insulation in above-grade exterior walls except at shower and tub walls.*

Note:

N1.18.2 *Class I vapor retarders, such as mirrors, may be used if mounted with clips or other spacers that allow air to circulate behind.*

1.19 Materials with Signs of Water Damage or Mold

Intro: *Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:*

1.19.1 Interior Inspection

1.19.1.1 The Verifier shall perform an inspection to identify areas of moisture intrusion in the building envelope. Inspection of wall sheathing behind exterior cladding must be done prior to insulation and interior finishes. Where moisture intrusion is evident behind cladding and fenestrations, cladding must be removed to address the integrity of flashing and the WRB. Where moisture intrusion is evident through roof assemblies, sufficient roofing materials must be removed to adequately repair leaks.

Note:

N1.19.1 Where preliminary interior inspection reveals areas of building envelope degradation or potential moisture intrusion, the Verifier shall determine if envelope repairs are required. Surfaces are not required to appear "new" cosmetically; however, areas of rot and decay must be repaired, including proper flashing and/or sealant to minimize moisture intrusion in the building assembly.

1.19.1.2 If visual mold and/or stains from water or fungal growth or moisture issues (e.g., condensation on pipes, leaks around windows, doors, wall penetrations, roofs, flashing, foundations, plumbing components, and fixtures, etc.) are evident, the source is identified, addressed, and remedied. Remediation shall be addressed by one of the following options:

i. If an area of suspected mold is less than 10 square feet, remediation can be addressed by the building owner (Refer to Mold Cleanup Tips and Techniques).

ii Areas of suspected mold larger than 10 square feet, or areas of any size that have been damaged by water containing sewage, shall be remediated in accordance with the recommendations in the EPA guide Mold Remediation in Schools and Commercial Buildings or the guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH). States and local agencies may require certification, trainings, or examinations for practitioners in the industry of mold remediation and environmental management. See EPA's list of state contacts to inquire about local requirements and recommended credentials at http://www.epa.gov/indoor-air-quality-iaq/epa-regional-office-and-state-indoor-air-quality-information.

1.19.1.3 *During construction and/or renovation, building materials with visible signs of water damage or mold are not installed or allowed to remain. Lumber with "sap stain fungi" is exempt from Item 1.19.1 as long as the lumber is structurally intact.*

1.19.1.4 *Framing members and insulation products having high moisture content are not enclosed (e.g., with drywall).*

Note:

N1.19.1.4 *For wet-applied insulation, follow the manufacturer's drying recommendations.*

Advisory:

A1.19.1.4 EPA recommends that lumber moisture content be ≤18%.

1.19.2 Exterior Inspection

1.19.2.1 Exterior above-grade surfaces (e.g., fenestrations, siding, flashing, roof-to-wall connections) are visually verified to be free from degradation or potential moisture intrusion. If evident, the source is identified, addressed, and remedied.

Note:

N1.19.2 Exterior surfaces can be inspected from the ground or from building openings (e.g., fenestrations). Where preliminary exterior inspection reveals areas of building envelope degradation or potential moisture intrusion, the Verifier shall determine if closer inspection and/or envelope repairs are required. Surfaces are not required to appear "new" cosmetically; however, areas of rot and decay must be repaired, including proper flashing and/or sealant to minimize moisture intrusion in the building assembly.

Advisories:

A1.19a Exterior wood surfaces should be back primed and coated with stain, paint, or equivalent.

A1.19b Install water-resistive barriers and protect building openings/fenestration immediately following rough framing.

A1.19c Remove standing water and use fans and/or dehumidifiers to remove moisture.

A1.19d If standing water or ice is found to be present following the completion of rough framing and dry-in activities, the Verifier should request a root cause analysis and corrective action plan to be included with final verification documents.

2. Radon

2.1 Radon Testing

Intro: Radon testing applies regardless of EPA Radon Zone or the presence of a radon mitigation system.

2.1.1 Upon completion of construction/rehabilitation, conduct radon testing in any building with ground-contact locations (as defined by ANSI/AARST MAMF 2017 with 01/2021 revisions). Single-family residences follow procedures outlined in ANSI/AARST MAH 2019. All other residential or mixed-use buildings follow procedures outlined in ANSI/AARST MAMF 2017 with 01/2021 additions. Testing is not required where the occupied space is located above an unenclosed open space. Employ one of the following methods:

2.1.1.1 Implement short-term tests (2 to 7 days) using passive samplers according to the instructions by the test kit manufacturer (unless otherwise required by state radon programs and/or local requirements); **OR**

2.1.1.2 Where continuous radon monitor (CRM) equipment is used, testing is performed by a qualified radon professional, as defined by Section 2.4 of ANSI/AARST MAMF 2017 with 01/2021 revisions.

2.1.2 Where initial radon testing results in ≥ 4 pCi/l levels, either:

2.1.2.1 Perform a long-term test (minimum 90 days) using a qualified radon professional to confirm average seasonal radon levels are < 4 pCi/l.; **OR**

2.1.2.2 Install an active radon mitigation system and retest demonstrating that radon levels have been reduced to < 4 pCi/l. Single-family residences shall install an active system(s) in accordance with ANSI/AARST SGM-SF 2017 with 12/20 revisions and retest according to Section 7.3 of ANSI/AARST MAH 2019. All other residential or mixed-use buildings shall install an active system(s) in accordance with ANSI/AARST RMS-MF-2018 with 12/2020 revisions and retest according to Section 7.3 of ANSI/AARST MAMF 2017 with 01/2021 additions.

2.1.3 Test results shall be included in the Occupant & Maintenance Manual(s) and maintained with Indoor airPLUS certification documents by the Verifier. Where radon systems (active or passive) are installed during construction or renovation, equipment manuals and maintenance guidance shall be included in the Occupant & Maintenance Manual(s).

Exception:

E2.1 Buildings with no ground contact locations (as defined by ANSI/AARST MAMF 2017 with 01/2021 revisions).

Advisory:

A2.1 Where radon reduction methods are employed during construction, EPA recommends following “ANSI/AARST CCAH-2020” for one- and two-family dwellings and townhomes and "ANSI/AARST CC-1000-2018” for multifamily buildings and mixed-use properties. Additional voluntary consensus standards for best practices in radon measurement and mitigation can be found at https://standards.aarst.org/.

3. Pest Barriers

3.1 Termite/Insect Prevention

3.1.1 Exterior penetrations (i.e., plumbing, electrical, etc.) and joints between the foundation and exterior wall assemblies are sealed where accessible.

3.1.2 There shall be no visible signs of active termite infestation or structural damage. Where active termite infestation is visible or suspected, see Item 3.4 for inspection and attestation requirements by a certified professional.

3.1.3 In jurisdictions designated by the code official as having a “Moderate to Heavy” termite infestation probability (e.g., 2021 IRC Table R301.2):

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

3.1.3.2 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.

3.1.4 In jurisdictions designated by the code official as having a “Very Heavy” termite infestation probability (e.g., 2021 IRC Table R301.2):

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

3.1.4.2 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.

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

3.1.4.4 Install a sealed termite shield extending a minimum of ¾ in. past the edges of the foundation wall assembly.

Advisory:

A3.1.4a 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.

A3.1.4b Install a steel mesh barrier termite control system and implement bi-annual inspections for termite nests and shelter tubes.

3.2 Rodent/Bird Screens for Building Openings

3.2.1 Corrosion-proof rodent/bird screens (e.g., copper or stainless-steel mesh) provided for all architectural openings that cannot be fully sealed.

3.2.2 Corrosion-proof screen, louver, or grille provided 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 2021 IRC 303.6. Screens for radon exhaust systems are not required, but where provided, screen mesh shall be no smaller than 1/2 in. square.

3.2.3 Dryer ducts include a weather-resistant termination or louver in accordance with dryer manufacturer's instructions. Where dryer vents include a grille, the majority of openings must be no less than ½ inch in any direction.

3.2.4 Screens are provided for all operable windows to prevent pest entry.

3.3 Multifamily Pest Management

3.3.1 Multifamily buildings include a pest management plan for the building maintenance staff or a documented contract with a pest management company aligning with the principles outlined in the EPA's guide on Integrated Pest Management in Buildings.

3.3.2 In owner/tenant manual, provide guidance for residents on housekeeping practices, refuse removal, and reporting pest problems promptly to building management.

3.3.3 Multifamily buildings include sanitary floor drains in common trash/recycling rooms. Floor drains shall include trap seal protection according to 2021 IRC P3201.2.1.

3.4 Pest-Contaminated Materials

3.4.1 There shall be no evidence of pest-contaminated materials inside the building envelope, inclusive of walls, floor systems, and attics.

Notes:

N3.4.1a Non-structural pest-contaminated materials shall be replaced, as necessary. Structural materials with prior pest contamination do not need to be removed if they have been cleaned and have not lost structural integrity.

N3.4.1b Where there are signs of pest infestation, or where pest contamination is suspected (e.g., due to odors, feces, etc.) a pest professional certified by the state or local jurisdiction, GreenPro, GreenShield, or an equivalent Integrated Pest Management (IPM) certification must inspect and provide documentation that pest infestations have been remediated or were not found during professional inspection.

Advisory:

A3.4 A letter from a structural engineer is recommended, but not required, for pest damaged structural building components.

4. Heating, Cooling, and Ventilation Systems

Heating and Cooling Design and Inspection

4.1 Heating and Cooling (HAC) Systems

Intro: Item 4.1 addresses design load calculations and system sizing specific to heating and cooling systems. For requirements related to ventilation, see Items 4.6-4.9. Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:

System Design

4.1.1 *All newly installed HAC systems serving dwelling units shall meet the design and documentation requirements of Sections 3-4 of ANSI/ACCA 5 QI – 2015, or Chapter 17 of the 2021 ASHRAE Handbook of Fundamentals*.

4.1.2 All newly installed HAC systems serving common spaces shall meet the design and documentation requirements of ANSI/ASHRAE/ACCA Standard 183 or Chapter 17 of the 2021 ASHRAE Handbook of Fundamentals.

Note:

N4.1a 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.

N4.1b While heating-dominant climates are allowed to over-size with respect to the cooling load in order to achieve higher energy efficiency in the winter, this design choice may impact the ability of the system to effectively provide humidity control (see Item 4.2).

N4.1c 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.

N4.1d 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 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.

System Performance

4.1.3 *For all newly installed HAC systems, documentation shall be provided to the Verifier, including start-up and air balancing reports or results of functional performance tests.*

4.1.4 All existing HAC system components shall be assessed in accordance with the applicable minimum inspection standards of ANSI/ACCA Standard 4 (Maintenance of Residential HVAC Systems), and the associated maintenance and service tasks shall be performed in accordance with the standard.

Note:

N4.1.4 Where inspection of existing HAC equipment reveals significant dirt, debris, biofilm, or fungal growth, clean and repair in accordance with ANSI/ACCA Standard 6 (Restoring the Cleanliness of HVAC Systems) or replace the system according to the newly installed criteria above.

Advisories:

A4.1a 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% of the design airflow rate when tested in accordance with ANSI / ASHRAE Std. 193.

A4.1b Although not required to meet this specification, Chapter 1 of the ASHRAE Handbook of Fundamentals or ACCA Manual P should be used to identify conditions that might lead to moisture issues and to verify that the design specifications fall within the 'Comfort Zone' on the psychrometric chart as defined by ANSI/ASHRAE 55.

A4.1c EPA recommends, but does not require that airflows from air balancing reports for all HAC supply registers and return grilles were measured using ANSI / ACCA 5 QI-2015 protocol and verified within the greater of ±20% or ±25 CFM of the design airflow.

A4.1d Multi-zone ductless systems may require supplementary dehumidification due to a lack of general distribution or circulation, the use of individual room controls, and the impact of door closures.

4.2 Humidity Control

4.2.1 A humidity monitoring device is provided in the main living area of the dwelling unit that includes a digital display of indoor temperature and relative humidity (RH) either on-board or via a web-based app. This requirement shall be met by either:

4.2.1.1 An RH monitor integrated with a thermostat or other central HAC controls; **OR**

4.2.1.2 A standalone digital hygrometer, either permanently mounted or portable.

Exception:

E4.2.1 Multifamily buildings 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:

A4.2.1 The ability to record RH data, either on-board or via a web-based app, for a minimum of 30 days is recommended.

4.2.2 Dwelling units in Moist (A) climate zones 1-4, as defined by 2021 IECC Figure R301.1, 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:

i. A ventilating or whole-home dehumidifier, plumbed to a discharge drain, and either integrated with a central HVAC system or ducted to serve the main body of the dwelling unit; OR

ii. All cooling systems equipped with additional controls to operate in dehumidification mode (i.e., systems that utilize humidity sensor feedback in the control algorithm to provide dehumidification, either automatically or on-demand, even when cooling is not required).

Note:

N4.2.2a "Whole-home dehumidifiers" are typically installed within the HAC ductwork to dehumidify multiple rooms and are often permanent. They may be installed separately from the HAC system and generally process indoor air only. "Ventilating dehumidifiers" process both indoor and outdoor air.

N4.2.2b Cooling systems only meet this requirement if they contain RH sensors that automatically turn the system off upon reaching the RH setpoint AND either prevent over-cooling or provide re-heat in order to maintain indoor temperature setpoints. For systems that limit over-cooling, the system is allowed to turn off without reaching the RH setpoint. Cooling systems with on-demand 'dry mode', like ductless mini-splits, must still meet the same requirements above.

Exception:

E4.2.2 Dwelling units in Climate Zone 4A meet this requirement if all of the following are provided:

i. The installed humidity monitoring device has the ability to record RH data, either on-board or via a web-based app, for a minimum of 60 days.

ii. The building owner is provided an estimate of the projected hours per year when the building/unit will exceed 60% RH, using residential building modeling tools with hourly simulations.

iii. Where the hours exceed 876 (i.e., 10% of the year), a dedicated space, drain, and electrical hook-up is provided to facilitate the future installation of a supplemental dehumidification system.

Advisories:

A4.2a EPA recommends, but does not require, that cooling systems in hot/humid climates utilize controls for immediate blower shutoff after condenser shutoff, to prevent re-evaporation of moisture off the wet coil.

A4.2b An additional dehumidification system (in lieu of additional HAC controls) is recommended in "Warm-Humid" climates, as defined by 2021 IECC Figure R301.1.

A4.2c 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 low 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 owners/occupants with instructions from the manufacturer on proper use and maintenance of the humidifier, including the recommendation to use distilled water.

A4.2d EPA recommends that the indoor dew point temperature be maintained below 60 °F (15 °C) whenever the outdoor air dew point is above 60 °F (15 °C).

4.3 Heating and Cooling (HAC) Duct Systems

Intro: Item 4.3 applies to all ducted systems providing heating and/or cooling (HAC) to the building. HAC ductwork must be inspected and tested per the following requirements. Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:

Duct Design

4.3.1 *In detached one- and two-family buildings and townhouses, all newly installed duct systems are sized according to ACCA Manual D. All other dwelling units may use an equivalent duct design standard.* The duct system shall be designed to account for the pressure drop associated with a minimum 2" deep filter rated MERV 13 or higher (see Item 4.11 for filter requirements).

4.3.2 In common spaces, all newly installed duct systems are sized according to ASHRAE Handbook of Fundamentals or other equivalent computation procedure. The duct system shall be designed to account for the pressure drop associated with a MERV 13 or higher filter (see Item 4.11).

4.3.3 Building framing cavities, such as any framing space (i.e., between wall studs, floor joists, or ceiling joists), shall not be used as supply or return ducts or plenums.

Advisory:

A4.3.3 A right-sized, fully ducted return is recommended to help ensure adequate return air through the filter to the air-handling equipment, rather than a transfer grille or louvered door to the space containing the air-handling equipment.

Duct Inspection

4.3.4 Inspect ductwork by removing registers, grilles, and diffusers to verify ducts and duct boots are dry, substantially free of loose dust and debris, and free of visible mold growth, rodents, or insects. When installed during new construction, cleanliness of duct boots can be confirmed by the Verifier using documentation provided by the HVAC contractor or builder at the time of register/diffuser installation.

Note:

N4.3.4 Where duct systems are found to have excessive dust and debris, duct boots must be thoroughly vacuumed prior to final inspection. Where duct systems are found to have visible mold growth or vermin infestation, ducts shall be cleaned in accordance with ANSI/ACCA Standard 6 (Restoring the Cleanliness of HVAC Systems). Prior to cleaning, retrofitting, or replacing any ducts or components of the duct system, the cause or causes of moisture or mold growth must be determined and corrected.

4.3.5 Ducts shall be in good condition (e.g., connected to boots, no tears in flex ducts), and exterior surfaces of ducts and insulation in and around insulated ducts shall be dry and free of mold.

Advisory:

A4.3.5 Metal supply ductwork that provides space cooling should be insulated (R-4 or greater) even when located within conditioned space, and the duct insulation should be sealed to the duct boots.

4.3.6 Ductwork installed outside the pressure boundary is sealed at transverse joints, longitudinal seams, duct wall penetrations, and duct boots sealed to drywall or subfloor using mastic systems, internal aerosol-based sealant, or UL-listed tapes used in accordance with their listing. Cloth duct tape is prohibited in all locations.

Advisories:

A4.3.6a Where tape is used for duct sealing, EPA recommends that it meet the applicable requirements of UL 181a or UL 181b.

Duct System Performance

4.3.7 *For dwelling unit systems, Verifier-measured total duct leakage is less than or equal to ENERGY STAR allowances.*

4.3.8 *For dwelling unit systems, Verifier-measured duct leakage to outdoors is less than or equal to ENERGY STAR allowances.*

4.4 Location of Heating and Cooling (HAC) Air-Handling Equipment and Ductwork

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

Note:

N4.4.1 In one- and two-family buildings 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.

Exception:

E4.4.1 This requirement does not apply to homes or buildings where the system provides heating and/or ventilation only for the garage, independent of systems that serve dwelling units.

Advisories:

A4.4.1a Air-handling equipment should be installed in a location accessible to the occupant, HVAC technician, or building maintenance staff to facilitate cleaning, maintenance, and to provide access to the heating and cooling cores and condensate pans. EPA recommends that access to an unvented attic should be provided by a permanent stair, a pull-down stair or ladder with a minimum capacity of 300 pounds (136 kg), or direct access to the equipment from a door (e.g., knee wall or unfinished mechanical room).

A4.4.1b In flood-prone areas, the HAC air-handling equipment is recommended to be installed above the 100 year flood level.

4.4.2 All newly installed and existing HAC air-handling equipment and ductwork must be located within the thermal and air barrier boundary to minimize the potential for future leakage to outdoors and associated pressure imbalances.

Note:

N4.4.2 This item does not apply to equipment or ductwork that only provide ventilation.

Exceptions:

E4.4.2a Ducts (but not air handlers) are permitted to be outside of the home/unit's thermal and air barrier boundary if total duct leakage is measured ≤ 1 CFM_{25} per 100ft^2 of conditioned floor area, at rough-in or final, with or without the air handler.

E4.4.2b Up to 10 ft. of total duct length is permitted to be outside of the home/unit's thermal and air barrier boundary.

E4.4.2c 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 ≤ 3 CFM_{25} per 100ft^2 of conditioned floor area, and:

i. In Moist (A) climate zones (per 2021 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**

ii. In Dry (B) and Marine (C) climate zones (per 2021 IECC Figure R301.1), ductwork is buried under at least 3.5 in. of blown-in insulation.

E4.4.2d Systems which meet the criteria for "Ducts Located in Conditioned Space" as defined by the 2018 IECC Section R403.3.7 or 2021 IECC Section R403.3.2.

E4.4.2e 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.

E4.4.2f Ducts and air-handling equipment may be located within an uninsulated and unvented crawl space or basement when dehumidification is used to meet the requirement of Item 1.8.

E4.4.2g Ducts and air-handling equipment associated with rooftop make-up air units or dedicated outdoor air systems (DOAS) that provide ventilation, but also provide supplemental heating and cooling, are permitted to be outside of the building's thermal and air barrier boundary.

4.5 Pressure-Balanced Bedrooms

4.5.1 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, meeting the following climate-specific requirements:

4.5.1.1 In Moist (A) zones 1-3, as defined by 2021 IECC Figure R301.1, bedrooms shall achieve a Verifier-measured pressure differential ≥ -3 Pa and ≤ +3 Pa with respect to the main body of the dwelling unit when all air handlers are operating.

4.5.1.2 In all other climate zones, bedrooms shall achieve a Verifier-measured pressure differential ≥ -5 Pa and ≤ +5 Pa.

Note:

N 4.5.1 Item 4.5.1 does not apply to ventilation ducts, exhaust ducts, or non-ducted systems. For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement. For an HVAC system with multiple zones, this requirement shall be verified with all zones calling for heating or cooling simultaneously; additional testing of individual zones is not required. When verifying this requirement, doors separating bedrooms from the main body of the house (e.g., a door between a bedroom and a hallway) shall be closed and doors to rooms that can only be entered from the bedroom (e.g., a closet, a bathroom) shall be open.

Mechanical Ventilation

4.6 Dwelling-Unit Mechanical Ventilation

Intro: Item 4.6 applies to all dwelling-unit mechanical ventilation systems. Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:

Ventilation System Design

4.6.1 Provide each dwelling unit with a "balanced" mechanical ventilation system.

Note:

N4.6.1a A "balanced" ventilation system shall be designed and installed to provide ventilation air directly to the dwelling unit from the outdoors. A "balanced" system may be an HRV or ERV but may also be a combination of mechanical supply and exhaust systems, without any heat or energy recovery. Exhaust-only or supply-only ventilation systems are prohibited.

N4.6.1b The system is considered "balanced" if the total supply and exhaust airflows measured in the dwelling unit are within 20% or 10 cfm of each other. When calculating the percentage, use the higher airflow as the basis. Where the supply and exhaust systems operate independently, EPA recommends, but does not require, simultaneous operation. If they operate on schedules with different airflow rates and run-times, apply the run-time to the measured airflow to calculate the average rate when determining if they are "balanced".

N4.6.1c 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. To balance the outdoor air supplied through the HAC air handler, a separate exhaust system is needed, that runs continuously or intermittently and automatically based on a timer or using controls interlocked with the motorized damper.

N4.6.1d Where an HRV/ERV or a powered supply fan is connected directly to the HAC ducting, both systems shall be interlocked to run simultaneously, without allowing the HAC air handler to run continuously.

Advisories:

A4.6.1a Where outdoor air ducts are connected to the return side of an air handler 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).

A4.6.1b EPA recommends installing ventilation equipment with automated fault detection and diagnostics for airflow rate, filter maintenance, and automatic balancing features to maintain balanced airflow rate in variable conditions and through the equipment life. EPA also recommends installing ventilation equipment with the capability to modify ventilation rates and run-times in response to monitored pollutants. Also note that IAQ contaminant monitoring systems may require regular maintenance, calibration, and/or replacement of sensor equipment

A4.6.1c EPA recommends multiple supply points to properly distribute outdoor air to all living spaces for all system types.

A4.6.1d Where installing heat or energy recovery ventilation systems, EPA recommends the following:

- **i.** Minimize intake and exhaust duct length.
- **ii.** Install the room exhaust points high on the walls or in the ceiling.

A4.6.1e Where installing powered supply ventilation as part of the balanced ventilation system, EPA recommends the following:

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

4.6.2 *In all dwelling units, mechanical ventilation override control is labelled. In detached one- and two-family buildings and townhouses, the override control must also be readily accessible to the occupant.*

4.6.3 *Air inlets are visually verified to pull air directly from outdoors, and not from attic, crawlspace, garage, or adjacent dwelling units*.

4.6.4 *Outdoor air inlets are located ≥ 2 ft. above grade or roof deck; ≥ 3 ft. distance from dryer exhausts and sources exiting the roof; and ≥ 10 ft. of stretched-string distance from known contamination sources not exiting the roof*.

Advisories:

A4.6.4a Ventilation equipment should be installed in a location accessible to the occupant, HVAC technician, or building maintenance staff to facilitate cleaning, maintenance, and to provide access to the heat exchange cores and/or condensate pans (if applicable).

A4.6.4b Outdoor air inlets should be located so that entering air is not obstructed by snow, plantings, or other material and in such a location to promote periodic cleaning.

Ventilation Rates and Run Times

4.6.5 Total outdoor air supplied to and exhausted from the dwelling unit shall be measured at both the supply and exhaust locations in accordance with ANSI / RESNET / ICC Std. 380 and documented to meet or exceed the dwelling-unit mechanical ventilation rates and run-time (continuous or intermittent) required in Section 4 of ASHRAE 62.2-2019, or later versions. Alternatively, the Verifier may collect and review a report provided by a certified air-balancing contractor.

Ventilation Filtration

4.6.6 Ventilation filtration shall be designed as follows:

4.6.6.1 Prior to distribution outdoor air supplied to the dwelling unit shall pass through a filter rated MERV 13 or higher according to ASHRAE 52.2-2017 or ISO ePM1 according to ISO 16890. Outdoor air supplied directly to a duct system that passes through the filter of the HAC air handler satisfies this requirement.

Advisory:

A4.6.6.1 The ventilation system should be designed to account for the pressure drop associated with the filter.

4.6.6.2 The ventilation filter shall be readily-accessible to the occupant, HVAC technician, or building maintenance staff.

Advisory:

A4.6.6.2 The outdoor air intake, fan unit, and heat exchanger (if applicable) should be installed in locations accessible to the occupant or building maintenance staff to facilitate cleaning, maintenance, and to provide access to the heat exchange cores and/or condensate pans (if applicable).

Sound Rating

4.6.7 Dwelling unit mechanical ventilation fans located within the dwelling unit shall be rated for sound at a maximum of 1.0 sone.

Exception:

E4.6.7 Sound ratings are not required for HAC air handlers used as part of the ventilation system and remote-mounted fans located outside the habitable space, bathrooms, toilets, and hallways, with at least 4 ft of ductwork between the fan and the intake grille.

4.7 Dwelling-Unit Bathroom Exhaust

Intro: Item 4.7 applies to all dwelling-unit bathroom ventilation systems. Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:

4.7.1 *In each bathroom, provide local mechanical exhaust ventilation directly to the outdoors, meeting ASHRAE 62.2-2019 Section 5 requirements.*

Note:

N4.7.1 Per ASHRAE 62.2, a bathroom is any room containing a bathtub, a shower, a spa, or a similar source of moisture.

4.7.2 Where provided, continuously-operating bathroom exhaust fans shall be rated for sound at a maximum of 1 sone at an airflow of 20 cfm or greater. Where provided, demand-controlled (i.e., intermittent) bathroom exhaust fans shall be rated for sound at a maximum of 3 sones at an airflow no less than 50 cfm.

Exception:

E4.7.2 Sound ratings are not required for remote-mounted fans located outside habitable spaces, bathrooms, toilets, and hallways, with at least 4 ft of ductwork between the fan and the intake grille.

4.7.3 Where the bathroom exhaust fan is part of the dwelling-unit mechanical ventilation system, the on/off control must be labelled or marked to clearly identify its dual function.

4.7.4 When using demand-controlled exhaust from bathrooms to meet ASHRAE 62.2-2019 Section 5 requirements, fans shall be provided with automatic controls based on humidity or occupancy, such that the fan can be operated when bathroom is occupied and for a minimum of 20 minutes after vacated, or until humidity is less than 60%.

4.8 Dwelling-Unit Kitchen Exhaust

4.8.1 In each kitchen, provide demand-controlled mechanical exhaust at each cooktop or range, vented directly to the outdoors, meeting ASHRAE 62.2-2019 Section 5 requirements by either a:

4.8.1.1 Range hood or appliance-range hood combination with a minimum Verifier-measured exhaust rate of 100 cfm; **OR**

4.8.1.2 Downdraft kitchen exhaust fan with a minimum Verifier-measured exhaust rate of 300 cfm or 5 ACH for enclosed kitchens.

Notes:

N4.8.1a Where microwave-range hoods are installed, Verifier shall verify that the microwave-range hood is configured to vent outdoors, rather than recirculate.

N4.8.1b Airflow measurements shall be taken at a speed setting which is rated for sound ≤ 2 sones.

Exceptions:

E4.8.1a While demand-controlled kitchen exhaust is recommended, for units in multifamily buildings, continuous exhaust vented to the outdoors (e.g., HRV/ERV or ceiling/wall mounted fan) may be used in lieu of a demand-controlled exhaust fan at the cooktop, if the following requirements are met:

i. Cooktop is electric,

ii. A recirculation range hood with a charcoal filter is installed over the cooktop,

iii. Continuous kitchen exhaust rate of either

a. 5 ACH, OR

b. 50 cfm if the edge of the exhaust fan or intake grille is located within 10 ft of the edge of the cooktop or range, as measured horizontally on the floor plan.

c. 25 cfm if local mechanical kitchen exhaust is provided using a balanced system and the building has a Verifier-measured whole-building infiltration rate ≤ 1.0 ACH50 or ≤ 0.05 CFM50 per sq. ft. of enclosure area.

Exception 4.8.1a does not apply to two-family buildings or townhouses. (See 4.8.2)

E4.8.1b Where microwave-range hoods are installed, measuring the exhaust airflow is not required, if the following requirements are all met:

i. Cooktop is electric,

ii. Measured duct length does not exceed 25 ft and contains no more than 3 elbows,

iii. Duct sizing meets Compliance Option 3 of the ENERGY STAR Kitchen Exhaust Guidance,

iv. Microwave-range hood is HVI or AHAM certified, or equivalent, and rated for at least 100 cfm at 0.25 in. WC (ratings at 0.1 in. WC are not acceptable for airflow, but are permitted for sound).

4.8.2 For all dwelling units, where continuous exhaust is present in the kitchen area and separate from the range hood, do not locate ventilation grilles above or inside a 45-degree angle projected outwards from the cooking equipment element closest to the grille and install a MERV 3 or washable filter in the ventilation grille to trap grease. 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.

4.8.3 Continuous kitchen exhaust fans shall be rated for sound at a maximum of 1 sone at an airflow no less than 25cfm. Demand-controlled kitchen exhaust fans shall be rated for sound at a maximum of 2 sones at one or more airflow settings no less than 100 cfm.

Exception:

E4.8.3 Sound ratings are not required for remote-mounted fans located outside habitable spaces, bathrooms, toilets, and hallways, with at least 4 ft (1 m) of ductwork between the fan and the intake grille.

Advisories:

A4.8a Range hoods and microwave-range hoods are recommended to have a minimum capture efficiency of 70%, as tested in accordance with current (or amended) editions of ASTM E3087, or equivalent.

A4.bc Demand-controlled kitchen exhaust fans capable of exhausting air at rates greater than 160 cfm are recommended; for gas cooktops, EPA recommends rates greater than 200 cfm. Where exhaust rates are 200 cfm or greater, units should be provided with makeup air at rates equal or similar to the exhaust air rate.

A4.8c Range hoods with "smart" controls that meet UL requirements for safety 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.

A4.8d To improve installed performance, EPA recommends the following:

i. Select products that are rated for airflow and sound in accordance with HVI 920, or equivalent, by an administration and certification body that is accredited in accordance with ISO 17065 and accredited by an accreditation body operating in accordance with ISO 17011.

ii. Select products that are rated for airflow at a minimum static pressure of 0.375 in. WC.

iii. For kitchen exhaust fans, even when Verifier-measurement of airflow is required, follow the prescriptive duct sizing requirements in Table 5-3 of ASHRAE 62.2-2019 or the ENERGY STAR Kitchen Exhaust Guidance.

iv. Select static vents and termination fittings certified to meet the required cfm at 0.05 in. WC in accordance with HVI 916 or equivalent.

4.9 Common Space Ventilation Requirements

Intro: Completion of the ENERGY STAR requirements satisfies the italicized Indoor airPLUS requirements:

Ventilation System Design

4.9.1 *Provide outdoor air ventilation and exhaust in common spaces of multifamily buildings. Air inlets are visually verified to pull ventilation air directly from outdoors, and not from attic, crawlspace, garage, or adjacent dwelling units.*

Ventilation Rates and Run Times

4.9.2 Ventilation and exhaust airflows shall be measured and documented to meet or exceed rates required by ASHRAE 62.1-2019. Alternatively, the Verifier may collect and review a report provided by a certified air-balancing contractor.

Ventilation Filtration and Maintenance

4.9.3 Ventilation filtration shall be designed as follows:

4.9.3.1 Prior to distribution, outdoor air supplied to common spaces in multifamily buildings shall pass through a filter rated MERV 13 or higher according to ASHRAE 52.2-2017 or ISO ePM1 according to ISO 16890.

4.9.3.2 The outdoor air intake, the filter, the fan unit, and the heat exchanger (if applicable) shall be installed in locations accessible to the building maintenance staff to facilitate cleaning and maintenance.

Advisory:

A4.9.3a The ventilation system should be designed to account for the pressure drop associated with the filter.

4.10 Other Ventilation Requirements

4.10.1 Central vacuum systems, where installed, shall exhaust to the outdoors at least 10 ft. from ventilation system air inlets.

4.10.2 Vented clothes dryers shall exhaust to the outdoors per the manufacturer's instructions.

Advisories:

A4.10a If the dryer exhaust duct exceeds the manufacturer's recommendations in length, diameter, turns, etc., a dryer exhaust duct power ventilator (DEDPV) certified for safety under UL507 should be installed.

A4.10b 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.

Filtration and Air Cleaning

4.11 Particle Filtration for Ducted Heating and Cooling (HAC) Serving Dwelling Units and Common Spaces

4.11.1 For all ducted HAC systems serving dwelling units and common spaces, filter slots shall be a minimum of 2in. in depth with filters rated MERV 13 or higher according to ASHRAE 52.2-2017 or ISO ePM1 according to ISO 16890 installed prior to final inspection. Alternatively, MERV 11 filters are permitted where a stand-alone portable air cleaner is provided for each of the two largest living spaces in the home/apartment. See Item 4.12 for design criteria.

Advisories:

A4.11.1a While not required, filter slots are recommended to be a minimum of 4in. in width to allow for deeper pleated filters and reduced pressure drop across the filter.

A4.11.1b 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.

A4.11.1c To reduce the likelihood of construction dust contaminating the ducts and air handler, the HAC system should not be used as temporary space conditioning during construction activities with increased dust (e.g., drywall sanding, floor sanding).

4.11.2 Return air filters shall be installed in locations accessible to the occupant or building maintenance staff for cleaning and/or replacement.

4.11.3 Filter access panels are equipped with gasketed material or comparable sealing mechanism to ensure access panels fit snugly against the exposed edge of the installed filter to prevent air bypass.

Advisory:

A4.11.3 Filters perform best when the filter rack design includes the following features, which are also included in some manufacturers' filter media boxes:

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

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

4.11.4 All return air and mechanically supplied outdoor air pass through filter prior to conditioning.

Advisory:

A4.11.4 To improve filtration during time periods where the HAC is not operating frequently (e.g., shoulder seasons), EPA recommends operating the air handler daily at a minimum runtime (20-30%) to provide filtration or the alternatives in Item 4.12 that do not utilize the HAC system.

4.11.5 Ducted electronic air cleaners (i.e., duct-mounted electrostatic air cleaners, air ionizers, and lamps that emit ultraviolet (UV) radiation between 100 and 280 nm (UVC)) are tested according to UL 2998 or CSA Standard C22.2 No. 187:20 and must not exceed ozone emission limits of 0.005 parts per million. Such devices are permitted, but are not required, in Indoor airPLUS labeled buildings and apartments.

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

Advisory:

A4.11.6 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.

4.12 Particle Filtration for Non-Ducted HAC Systems Serving Dwelling Units

4.12.1 In dwelling units with no ducted HAC system (e.g., ductless mini-splits, 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:

i. Non-ducted, forced-air HAC systems include a filter rated MERV 13 or higher according to ASHRAE 52.2-2017 or rated ePM1 according to ISO 16890; **OR**

ii. A stand-alone portable air cleaner is provided for each of the two largest living spaces in the home/apartment, 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 must meet ozone emission limits of UL 2998; **OR**

iii. Transfer fan is installed with a minimum MERV 13 filter designed to operate during all occupiable hours and to exchange air between the two largest living spaces (at minimum).

Advisory:

A4.12 In common spaces with no ducted HAC system, EPA recommends one of the above strategies to improve particle filtration.

4.13 Gas-Phase Air Cleaning Devices

4.13.1 Where installed, gas-phase air cleaning devices do not intentionally use ozone to treat or condition air.

Advisories:

4.13a 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. 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.

4.13b When utilized with in-duct HAC systems, gas-phase filters that contain sorbents should generally be located downstream of particle air filters.

4.14 Microbial Disinfection

4.14.1 Where installed, ultraviolet germicidal irradiation (UVGI) or other electronic air cleaners (e.g., plasma generators, photocatalytic oxidizers (PCOs), etc.) must not exceed ozone emission limits of 0.005 parts per million as specified in UL 2998.

Advisories:

A4.14a 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 buildings 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. 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.

A4.14b 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. Builders should ensure that homeowners and occupants are aware of the hazards related to accidental UV exposure and should brief them on the maintenance and usage requirements for any UVGI system installed.

A4.14c 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, including formaldehyde, other aldehydes, ketones, and peroxides. Usage of technologies that emit ozone should be carefully considered before being installed in buildings, and builders should ensure that homeowners and occupants are fully informed about the potential hazards and emission byproducts that may result from usage of these devices.

5. Pollutant Control

5.1 Combustion Appliances

5.1.1 Combustion furnaces, boilers, and water heaters located within the building's pressure boundary are mechanically drafted or direct-vented.

Advisory:

A5.1.1 EPA recommends mechanically drafted or directed vented equipment where combustion appliances are located in basements, crawlspaces, and/or garages outside the pressure boundary.

5.1.2 Fireplaces located within the building's pressure boundary are mechanically drafted or direct vented.

5.1.2.1 Liquid or gas-burning fireplaces shall have a permanently affixed tempered glass front or gasketed door.

5.1.3 No unvented combustion appliances other than cooktops, ranges, or ovens are located within the building's pressure boundary. See Item 4.8 for kitchen exhaust requirements.

5.1.4 Existing chimneys and flues still in service have passed a Level II inspection according to NFPA 211, as performed by a CSIA certified chimney sweep (or other similar certification).

Solid fuel burning fireplaces and appliances

5.1.5 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:

5.1.5.1 Site-built masonry fireplaces designed for open fires are sealed to prevent use or retrofitted with other compliant appliances;

Exception:

E5.1.5.1 "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).

5.1.5.2 Factory-built wood-burning fireplaces shall have a dedicated outside air supply and meet the certification requirements of UL 127.

Advisory:

A5.1.5.2 Factory-built wood burning fireplaces qualified under EPA's wood-burning fireplace program are recommended. See: https://www.epa.gov/burnwise/voluntary-fireplace-program.

5.1.5.3 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: https://www.epa.gov/residential-wood-heaters/final-2020-new-source-performance-standards-residential-wood-heaters.

5.1.5.4 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.

5.2 Carbon Monoxide Alarms

5.2.1 All dwelling units shall have a carbon monoxide (CO) alarm installed and located in accordance with all the following:

5.2.1.1 In the same room as permanently installed fuel burning appliances.

5.2.1.2 Centrally located on every habitable level.

5.2.1.3 Within 21 ft (6.4 m) of any door to a sleeping room.

Advisory:

A5.2.1 Avoid placing CO alarms near heating vents, in kitchens, above fuel burning appliances, or in locations that can be covered by furniture or draperies.

5.2.2 Single and multiple station CO alarms shall be listed and labeled in accordance with UL 2034 or CSA 6.19-01. CO detectors for use in CO detection systems shall be listed and labeled in accordance with UL 2075.

5.2.3 CO alarms shall be powered from the building's wiring with battery backup. CO alarms in buildings without a commercial power source are permitted to be battery operated.

5.2.4 CO alarm must sound when the test button is pushed.

5.2.5 Where CO alarms are installed prior to construction finishes, alarms shall be protected from dust, paint, and other contaminants.

Note:

N5.2 The above requirements are not intended to supersede or replace applicable laws or codes in force by the authority having jurisdiction. Additional local requirements may apply.

Advisory:

A5.2 For added protection for young children, expectant parents, older adults, and persons with medical conditions who may be more vulnerable to lower levels of carbon monoxide, EPA recommends that CO detectors are installed that display and alarm at levels that are lower than UL 2034 alarm thresholds.

5.3 Pollutant Control from Smoking and Vaping

5.3.1 Occupant has been provided with EPA's brochure on Secondhand Tobacco Smoke and the Health of Your Family or with a link to EPA's resources on Secondhand Smoke and Smoke-free Homes.

5.3.2 In multifamily buildings, smoking and vaping are prohibited in indoor common areas, including but not limited to, corridors, vestibules, stairwells, and community rooms, and the prohibition is posted in a prominent entryway or lobby. The prohibition is explicitly communicated in the building rental or lease agreements or in condo or co-op association covenants and restrictions, with provisions for enforcement.

5.3.3 In multifamily buildings, when designated outdoor smoking/vaping areas are provided, they are located a minimum of 25 ft. from entries, outdoor air intakes and operable windows, and signage is provided.

Advisories:

A5.3a EPA recommends prohibiting smoking and vaping of tobacco or other substances throughout the entire building, including within living units, on patios, and balconies. Communicate these additional prohibitions in the building rental or lease agreements or in condo or co-op association covenants and restrictions and include provisions for enforcement.

A5.3b Exposure to contaminants is not limited to tobacco smoke. 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 or incense.

5.4 Pollutant Control through Minimized Infiltration

5.4.1 Conduct airtightness testing in accordance with procedures in ANSI/RESNET/ICC Std. 380, demonstrating compliance with the following leakage rates, as applicable to the type of dwelling unit:

5.4.1.1 For detached homes > 1,000 ft^2, Verifier-measured airtightness shall be no greater than 3 ACH50. For detached homes ≤ 1,000 sq.ft., Verifier-measured airtightness shall be no greater than 0.23 CFM50 per square foot of dwelling unit enclosure area.

5.4.1.2 For all other dwelling units, the average compartmentalization of all Verifier-measured airtightness test results shall be no greater than 0.23 CFM50 per square foot of dwelling unit enclosure area. In multifamily buildings, where sampling of compartmentalization tests is permitted, test at least 20% of the dwelling units that are adjacent to the garage.

5.5 Attached Garages and Parking Structures

5.5.1 *Common walls and ceilings between attached garages and occupied spaces, including common spaces, are air-sealed before installing insulation. Doors between occupied spaces, including common spaces, and attached garages are made substantially air-tight with weather stripping or equivalent gasket.*

5.5.1.1 An automatic door closer is installed on doors between garages and occupiable space.

5.5.2 In detached one- and two-family buildings and townhouses, meet one of the following two requirements:

5.5.2.1 Verify that the garage-to-house air barrier can maintain a pressure difference of greater than 45 Pa while the house maintains a 50 Pa pressure difference with respect to the outdoors. All operable garage openings shall be closed during this test; **OR**

5.5.2.2 Equip the attached garage with an exhaust fan that is vented directly outdoors. The installed fan shall have a minimum Verifier-measured 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:

A5.5.2a EPA recommends installing a garage exhaust fan capable of moving 0.75 cfm per square foot if the occupant is expected to occupy the garage for work or recreational activities over extended periods of time.

A5.5.2b EPA recommends installing ENERGY STAR certified exhaust fans to reduce energy consumption and sound levels.

A5.5.2c EPA recommends providing occupants with information in the Owner and Occupant Information Kit on the importance of, and methods for, ensuring adequate ventilation in the garage while occupied for extended periods of time.

5.5.3 *In multifamily buildings, where an exhaust system is installed in a shared parking garage, it is equipped with controls that sense CO and NO_2, providing a minimum continuous ventilation rate of 0.05 cfm/ft^2 in standby mode, and 0.75 cfm/ft^2 otherwise.*

5.6 Combustible Fuels

5.6.1 There shall be no combustible liquid or gas fuels (e.g., gasoline, kerosene, propane, ethanol, etc.) stored within the thermal and pressure boundary upon final verification.

5.6.2 Supplemental portable combustion equipment (e.g., portable generators, lawn maintenance equipment, etc.) shall not be operated or stored within the thermal and pressure boundary upon final verification.

6. Building Materials

Intro: The following section applies to newly installed materials and finishes. Surfaces in garages are exempt for the purpose of these requirements.

Notes:

N6a 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 to reduce ambient air emissions.

N6b EPA recommends ventilating 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.

N6c Interior architectural coatings, gypsum board, and other products 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 in this section. EPA has not independently evaluated data on the relative efficacy and long-term impacts of sorptive materials addressed by the ISO 16000-23 standard.

N6d 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.*]

6.1 Composite Wood

6.1.1 For structural plywood and oriented strand board (OSB), install 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*.

6.2 Interior Paints, Finishes, and Coatings

6.2.1 Site-applied paints, finishes, and coatings (including such products with sealing or waterproofing properties) shall not exceed 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."

6.2.2 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:

6.2.2.1 South Coast Air Quality Management District (SCAQMD), "Rule 1113 – Architectural Coatings, Amended February 5, 2016;" OR

6.2.2.2 California Air Resources Board (CARB), "Suggested Control Measure for Architectural Coatings, May 2020."

Notes:

N6.2 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 6.3, 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."

6.3 Carpets and Cushions

6.3.1 Carpet and carpet cushions must use low-emitting products with maximum VOC emission levels in accordance with and determined by CDPH Standard Method V1.2-2017.

6.4 Adhesives and Sealants

6.4.1 Site-applied interior adhesives and sealants shall not exceed maximum VOC emission levels in accordance with and determined by CDPH Standard Method V1.2-2017.

6.4.2 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:

N6.4 Some liquid finishing products labeled as "sealants" by the manufacturer may actually be better categorized as a coating or finish, and thus apply to Item 6.1. 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

6.5.1 Interior hard surface flooring materials and underlayments shall not exceed maximum VOC emission levels in accordance with and determined by CDPH Standard Method V1.2-2017.

Exception:

E6.5.1 Materials that are inherently non-emitting sources of VOCs, which include stone, ceramic, metals, glass, concrete, and clay brick.

6.6 Gypsum Board

6.6.1 Interior gypsum board and joint compound shall not exceed maximum VOC emission levels in accordance with and determined by CDPH Standard Method V1.2-2017.

6.7 Insulation

6.7.1 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:

E6.7.1a Pipe insulation.

E6.7.1b Board insulation installed outside the exterior sheathing.

6.8 Asbestos

6.8.1 Verifier has visibly inspected all accessible areas of the building, including ductwork in basements, crawlspaces, and attics, and identified possible asbestos containing materials (ACM). Where ACM are not found or are documented to have been previously mitigated or encapsulated by a licensed professional, no further action is necessary. Where ACM is suspected to be present, Verifiers shall not conduct any air infiltration or duct testing until Item 6.8.1.1 and 6.8.1.2 have been satisfied.

6.8.1.1 Where ACM are suspected to be present and not properly encapsulated, a qualified Asbestos Inspector shall verify upon completion of retrofit activities that ACM has been properly removed and disposed of or has been properly encapsulated.

6.8.1.2 The verification report shall also include proof of accreditation to perform asbestos inspections and/or mitigation work. Documentation shall be collected and maintained by the Verifier.

Advisories:

A6.8a EPA recommends, but does not require, the Asbestos Inspector to be a separate entity from the Verifier and contractor performing asbestos work.

A6.8b Persons who inspect, repair, or remove asbestos-containing materials should be trained and accredited by a state program at least as stringent as the EPA Asbestos Model Accreditation Plan (MAP). Ensure workers hired to handle asbestos are trained and accredited. State agencies have the most up-to-date listings of accredited professionals in your area.

A6.8c For more information, visit www.epa.gov/asbestos.

6.9 Lead-Based Paint

6.9.1 For homes and multifamily buildings undergoing gut rehabilitation that were built before 1978 and have not previously been found to be free of lead-based paint by a certified inspector, a lead-based paint inspection or risk assessment shall be conducted by a certified inspector or certified risk assessor. Documentation shall be collected and maintained by the Verifier.

6.9.2 When a lead-based paint inspection results in the identification of lead-based paint, conduct a risk assessment with a certified risk assessor.

6.9.2.1 Any lead-based paint hazards identified in a risk assessment must be mitigated according to the recommendations in the report, and in compliance with EPA lead-based paint regulations and any state or local lead-based paint regulations.

6.9.2.2 Any abatements conducted as a result of the risk assessment must be conducted under the EPA Lead Abatement Program, or an authorized program if one exists for the particular state or tribe.

6.9.3 When disturbing more than 6 sq.ft. of interior surfaces or 20 sq.ft. of exterior painted surfaces containing lead-based paint (as indicated in the inspection or risk assessment required above), the EPA Lead RRP Program, or an authorized program (if one exists for the particular state or tribe) must be followed.

Advisory:

A6.9.3 In addition to practices required by the EPA or an authorized program, conduct the following as indicated by the Department of Housing and Urban Development's (HUD) Lead Safe Housing Rule:

i. Lower the threshold for an interior painted surface area from 6 sq.ft. to 2 sq.ft.

ii. After the job is complete, conduct a clearance examination using EPA's dust-lead clearance levels.

7. Occupant Education

7.1 Owner and Occupant Information Kit

7.1.1 For newly installed appliances and systems, instruction manuals are provided to the occupant, building owner, or property manager for the following: HAC systems and accessories, ventilation systems (both local and whole-dwelling), air cleaners, dehumidifiers, moisture and/or IAQ monitors, combustion appliances, sump pumps, and radon systems (if installed).

7.1.2 For owner-occupied units, provide the occupant with operations and maintenance recommendations, including suggested schedules and sources for the replacement of filters in all ventilation and air handling equipment.

Advisory:

A7.1 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
ANSI/AARST CC-1000	Soil Gas Control Systems in New Construction of Buildings
ANSI/ AARST CCAH	Reducing Radon in New Construction of One & Two Family Dwellings & Townhouses
ANSI/AARST MAH	Protocol for Conducting Measurement of Radon and Radon Decay Products in Homes
ANSI/AARST MAMF	Protocol for Conducting Measurement of Radon and Radon Decay Products in Multifamily Buildings
AC115	Acceptance Criteria for Waterproof Membranes for Flooring and Shower Lining
ACCA	Air Conditioning Contractors of America
ACCA Manual D	Residential Duct Design
ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos containing materials
AHAM	Association of Home Appliance Manufacturers
ANSI	American National Standards Institute
ANSI/ASHRAE 62.1-2019	Ventilation for Acceptable Indoor Air Quality
ANSI/ASHRAE 62.2-2019	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
APA	The Engineered Wood Association
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASTM	American Society for Testing and Materials
CADR	Clean Air Delivery Rate
CARB	California Air Resources Board
CSIA	Chimney Safety Institute of America
ccSPF	Closed Cell Spray Polyurethane Foam
CDPH	California Department of Public Health
CFDS	Composite Foundation Drainage System
cfm	Cubic feet per minute
CI	Condensation Index
CO	Carbon monoxide
CZ	Climate Zone
DLTO	Duct Leakage to Outdoors
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
ft.	Feet
HAC	Heating and cooling
HCO	Home Certification Organization
HUD	Department of Housing and Urban Development
HVAC	Heating, ventilating, and air conditioning
IAQ	Indoor Air Quality
ICC	International Code Council
IECC	International Energy Conservation Code
IMC	International Mechanical Code
In.	Inches
IRC	International Residential Code
ISO	International Organization for Standardization
MERV	Minimum Efficiency Reporting Value defined in ASHRAE 52.2-2017
MF	Multifamily
mil	Common term to describe plastic sheeting thickness; 1 mil equals 0.001 inches
min.	Minimum
NFPA	National Fire Protection Association
NO_2	Nitrogen Dioxide
NFRC	National Fenestration Rating Council
Pa	Pascal
pCi/L	Picocuries per liter
RH	Relative humidity
SCAQMD	South Coast Air Quality Management District
spec.	Specification
sq. ft.	Square foot
UL	Underwriter Laboratories
UV	Ultraviolet light
UVC	UV: 200 nm to 280 nm
UVGI	Ultraviolet germicidal irradiation
VOC	Volatile Organic Compound
w.c.	Water column
WRB	Water resistive barrier

References

2021 ASHRAE Handbook of Fundamentals

ACCA Manual D: Residential Duct Systems. Third Edition Version 2.5- 2016. Air Conditioning Contractors of America.

ACCA Manual P: Psychrometrics

ANSI/AARST CCAH 2020: ANSI/AARST Standard: Reducing Radon in New Construction of 1 & 2 Family Dwellings and Townhouses. 2020. American Association of Radon Scientists and Technologists.

ANSI/AARST CC-1000 2018: ANSI/AARST Standard: Soil Gas Control Systems In New Construction of Buildings. 2018. American National Standards Institute / American Association of Radon Scientists and Technologists.

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/AARST RMS-MF 2018: Radon Mitigation for Multifamily Buildings

ANSI/AARST SGM-SF 2017: Soil Gas Mitigation Standards for Exiting Homes

ANSI/ACCA 5 QI – 2015: ANSI/ACCA HVAC Quality Installation Specifications

ANSI/ACCA 12 QH – 2018: Home Evaluation and Performance Improvement

ANSI/ACA Standard 6: Restoring the Cleanliness of HVAC Systems

ANSI/AHAM Standard AC-1-2020:Portable Electric Room Air Cleaners – Method for Measuring Performance of Portable Household Electric Room Air Cleaners

ANSI/ASHRAE/ACCA Standard 4-2013: Maintenance of Residential HVAC Systems

ANSI/ASHRAE 55-2020: Thermal Environmental Conditions for Human Occupancy

ANSI/ASHRAE Standard 193-2010 (RA2014): Method of Test for Determining the Airtightness of HVAC Equipment

ANSI/ASHRAE Standard 185.1-2020: Method of Testing UV-C Lights for Use in Air-Handling Units or Air Ducts to Inactivate Airborne Microorganisms

ANSI/ASHRAE Standard 185.2-2020: Method of Testing Ultraviolet Lamps for Use in HVAC&R Units or Air Ducts to Inactivate Microorganisms on Irradiated Surfaces

ANSI/BPI 1200-S 2017: Standard Practice for Basic Analysis of 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/ICC 301-2022: Standard for the Calculation and Labeling of the Energy Performance of Dwelling and Sleeping Units

ANSI/ASHRAE/ACCA Standard 183, 2013 or 2017: Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings.

ANSI/NFRC 500-2020: Procedure for Determining Fenestration Product Condensation Index Ratings

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 52.2-2017: Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. 2017. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

ASHRAE 62.1: ANSI/ASHRAE Standard 62.1-2022: [found in item 4.9.2] Ventilation and Acceptable Indoor Air Quality. 2022. American Society of Heating, Refrigerating, and Air-Conditioning Engineers

ASHRAE 62.2: ANSI/ASHRAE Standard 62.2-2019: Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. 2019. American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

ASTM E1509: ASTM Standard E1509-04: Standard Specification for Room Heaters, Pellet Fuel-Burning Type. 2004 (RA2013). 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.

ASTM D3273-2000: Fungal Resistance Test for Coated Surfaces

ASTM D6329-1998: Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers

ASTM E3087-2018: Standard Test Method for Measuring Capture Efficiency of Domestic Range Hoods

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.

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.

California Air Resources Board: Suggested Control Measure for Architectural Coatings. May 2020.

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 (R2016): Residential Carbon Monoxide Alarming Devices. 2001 (Reaffirmed 2016). Canadian Standards Association.

CSA Standard C22.2: Electrostatic air cleaners. 2020. Canadian Standards Association.

ENERGY STAR Residential New Construction Programs: U.S. Environmental Protection Agency. http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_v3_guidelines.

ENERGY STAR Kitchen Exhaust Guidance: Item 8.1 of the National Rater Field Checklist requires that a local mechanical exhaust system be installed in each kitchen and exhaust directly to the outdoors.

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.

EPA's Secondhand Tobacco Smoke and the Health of Your Family. Informational handout on the dangers of secondhand smoke from the EPA.

EPA's Asbestos Model Accreditation Plan - 1998: A plan that mandates safety training for those who do asbestos removal work, implementing training requirements for schools, as well as asbestos workers in public and commercial buildings.

EPA's Lead Abatement Program-1996: A framework for lead abatement, risk assessment, and inspections.

EPA's Lead Renovation, Repair and Painting (RRP) Program -2008 (Amended 2010 and 2011): Aims to protect the public from lead-based paint hazards associated with renovation, repair, and painting activities.

EPA's New Source Performance Standard: Clean air standards for residential wood heaters. 2015. U.S. Environmental Protection Agency.

EPA Residential Air Cleaners – A Technical Summary. 2018. U.S. Environmental Protection Agency.

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.

HVI 920: Product Performance Certification Procedure Including Verification and Challenge updated February 28, 2020.

HVI 916: Air Flow Test Procedure updated September 29, 2015

ICF: International Builders Code 2018

ICC-ES per AC 115 (from N1.14.1)

IECC: International Energy Conservation Code. 20218. International Code Council, Inc.

IRC: International Residential Code for One- and Two-Family Dwellings. 2021. International Code Council, Inc.

ISO ePM1: Based on ISO 16890 refers to the particle size fraction in the range from 0.3 µm to 1 µm

ISO ePM2.5: Based on ISO 16890 refers to the particle size fraction in the range from 0.3 µm to 2.5 µm

ISO 16890-1: 2016: Establishes an efficiency classification system of air filters for general ventilation based upon particulate matter (PM).

ISO 17065: Product Certification Bodies Accreditation

ISO 17011: 2004: Specifies general requirements for accreditation bodies assessing and accrediting conformity assessment bodies (CABs).

ISO 16000-23:2018: Specifies a general laboratory test method for evaluating the reduction of formaldehyde and other carbonyl compounds.

NFPA 72: Standard for the Installation of Carbon Monoxide (CO) Detection and Warning Equipment. 2012. National Fire Protection Association.

NFPA 211 (2019): Standard for Chimneys, fireplaces, Vents, and Solid Fuel Burning Appliances

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.

South Coast Air Quality Management District (SCAQMD): Rule 1113 – Architectural Coatings

South Coast Air Quality Management District: Rule 1168 – Adhesives and Sealant Applications

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

UL 181A: Standard for Closure Systems for Use with Rigid Air Ducts. 20013 (ANSI Approved 2021). Underwriters Laboratories, Inc.

UL 181B: Standard for Closure Systems for Use with Flexible Air Ducts and Air Connectors. 20013 (ANSI Approved 2021). Underwriters Laboratories, Inc.

UL 507 2017: (ANSI Approved 2022): Electric Fans

UL 1482: (ANSI Approved 2022): Standard for Solid-Fuel Type Room Heaters. 2011. Underwriters Laboratories, Inc.

UL 2034: (ANSI Approved 2022): Standard for Single and Multiple Station Carbon Monoxide Alarms. 2017. Underwriters Laboratories, Inc.

UL 2998 2020: Zero Ozone Emissions Validation

UL 2075 2013: (ANSI Approved 2021) Standard for Safety Gas and Vapor Detectors and Sensors

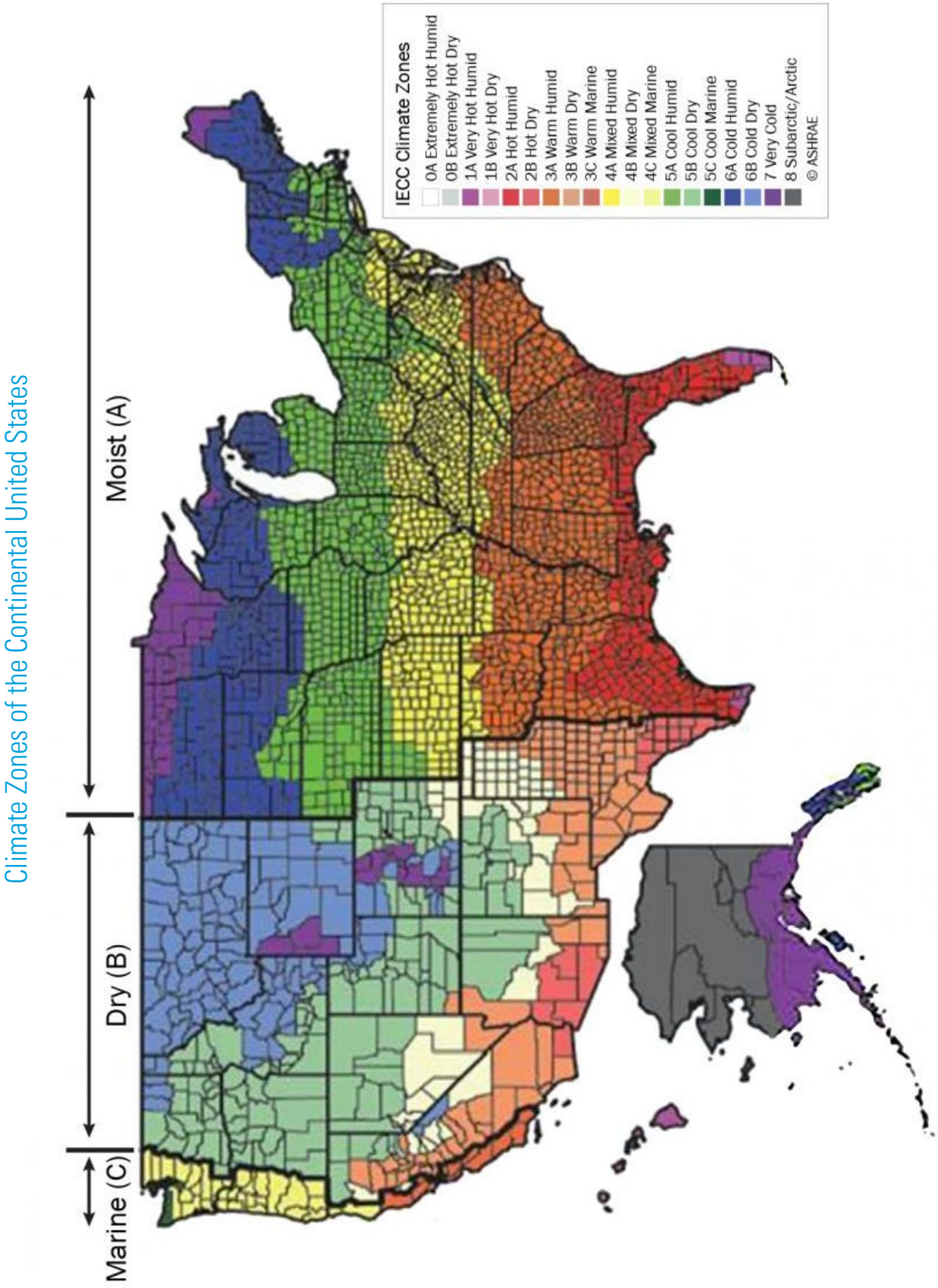

Figure R301.1 Climate Zones of the Continental United States. International Energy Conservation Code

United States Environmental Protection Agency

Office of Air and Radiation (6609J)

February 2023 – DRAFT ONLY

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

www.epa.gov/indoorairplus