



Duke Energy Progress Residential New Construction Program

Townhome Air Sealing Strategies





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Introduction

Air sealing of townhomes and multifamily projects continues to be a sticking point for many builders in North Carolina. While there are several approaches to effectively air seal the fire separation wall, fire code regulations and interpretations differ drastically by jurisdiction. Some localities require an air gap between framing and the separation wall, and do not permit any use of single part foam. Others may allow foam, gypsum “strips”, drywall slurry, or gaskets provided that the breakaway clips are not inhibited.

As air sealing requirements continue to become more stringent, it is important for the program to help builders address air leakage points related to the separation wall. While the air sealing strategies outlined in this training can help to address air leakage, it is important to consult your local fire code officials to ensure that all fire safety codes are met. Duke is currently working with Advanced Energy to conduct a comprehensive study to identify the fire code regulations around the separation wall and air sealing. Those findings will be released when available.

To minimize air leakage, we recommend a 3-tiered approach which includes ensuring the exterior boundaries are sealed completely, compartmentalization, and air sealing any bypasses from the drywall into the fire separation wall shaft. This document provides suggestions for each stage.

I. Air Sealing Exterior Boundaries

Similar to single family construction exterior boundaries are critical air sealing locations. While this document focuses specifically on the fire separation wall, builders should be diligent in air sealing all exterior walls. Section 4 of the ENERGY STAR® Thermal Enclosure System Rater Field Checklist offers excellent guidance for air sealing. A copy is included in the [appendix](#) of this document.

Phase 1: Framing

Be sure to address the installation gap after fire separation wall is installed. This is one of the largest air sealing “misses” in townhome construction, particularly around the floor systems. It is important that this area is addressed before Tyvek or exterior sheathing as it is nearly impossible to treat from the interior.



Purchasing Recommendation: Include a few cans of spray foam in the framing package and directly address this area in the framing subcontract.

Phase 2: Interior Sealing

Top plates adjacent to attic space should be treated to ensure there is not an active chase into the attic. This can be accomplished with blocking and single part foam, 2-part foam, or a combination of gypsum and fire caulk.



Top plate treated with single part foam.

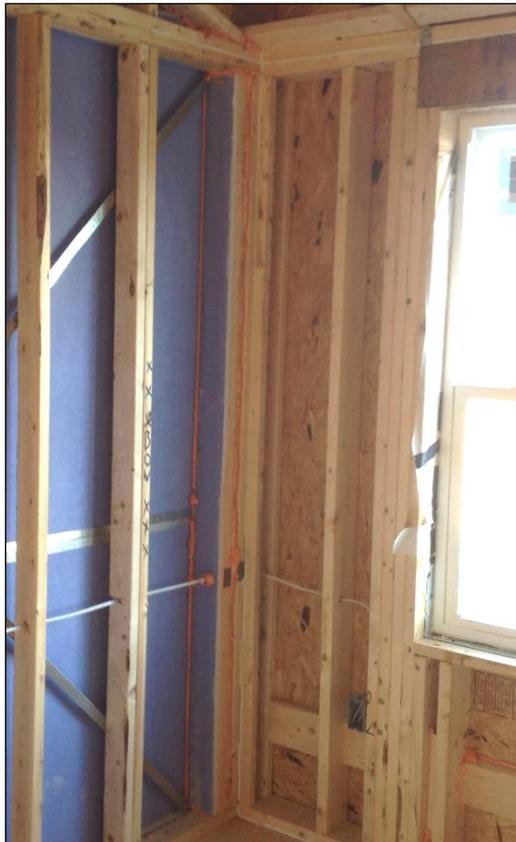


Top plate treated with open cell spray foam.



Top plate treated with gypsum and fire caulk.

Phase 2 Continued: Exterior walls corners adjacent to the fire separation wall should be inspected and air sealed with foam or a combination of gypsum and fire caulk.



Exterior wall intersection treated with gypsum & fire caulk.



Exterior perimeter treated with open cell foam.



Single Part Foam Treatment

II. Compartmentalization

Blocking of chases when they travel between floors is typically required by fire code. We recommend checking these locations to ensure they are air tight as possible. By compartmentalizing the core wall shaft, air leakage that may occur from outside the envelope will be confined to a single area rather than spread throughout the home. In the case of an air sealing failure, this approach helps to identify and target specific areas.



Compartmentalization using single part foam. Note that the aluminum clips from the fire separation wall are not covered.



Compartmentalization using open cell foam.



Compartmentalization using gypsum and fire caulk or single part foam.



While mineral wool is considered fire stopping, it is NOT an air barrier. The approach above can meet fire code, but will NOT help infiltration issues.

III. Drywall Bypasses

Ensuring that the drywall adjacent to the first separation wall is completely air sealed is critical. This creates a redundant pressure boundary ensuring that any air that may enter the shaft will be blocked from reaching the home. Building Science Corporation released Information Sheet 401 which is included at the end of this document. It is an excellent resource detailing the process for airtight drywall. At a minimum three areas should be treated.

Phase 1: Drywall Gasket

Gasket materials should be applied to all perimeter areas of the drywall assembly. This includes:

- All top and bottom plates
- Rough opening perimeters
- Both sides of each partition wall stud (think picture framing)

Acceptable gasket materials include:

- Drywall Adhesive (be sure to visually confirm this actually gets installed)
- EPDM or Foam Gasket
 - Denarco Sureseal (<https://denarcoinc.com/product-category/standard-drywall-gasket/>)
 - Conservation Tech (http://www.conservationtechnology.com/building_gaskets.html)
- Flexible, Non-Hardening Caulk (not construction adhesive)



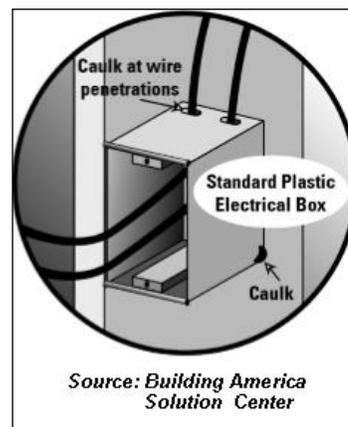
EPDM gaskets installed prior to drywall.

Phase 2: Electrical Boxes (Rough In)

Ensure the knockouts of all electrical boxes are air tight or sealed with foam once wires are pulled.



Air-tight electrical boxes with rubber gaskets at electrical knockouts.

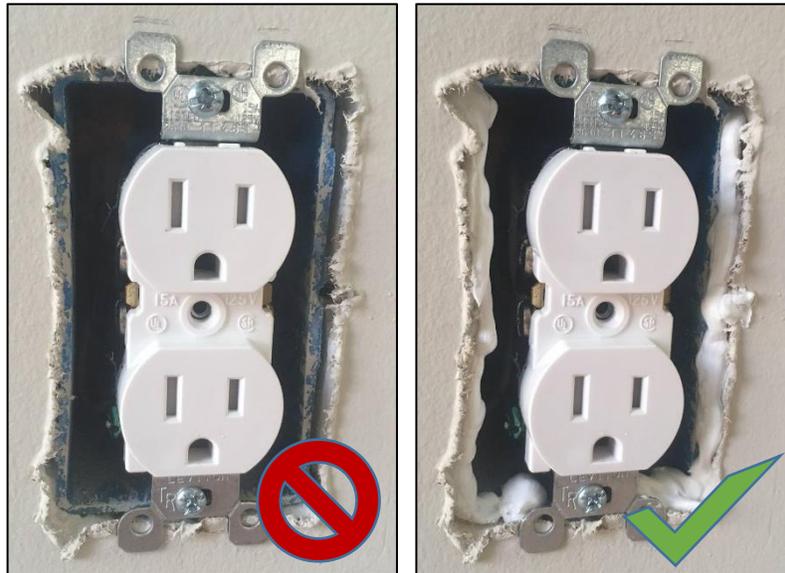


Source: Building America
Solution Center

Standard electrical boxes can be treated with single part foam after wires pulled.

Phase 3: Electrical Boxes (Post Drywall)

Ensure all electrical boxes are sealed to drywall prior to final. This can be completed by using a gasketed electrical box (as show above) or by caulking a standard box to the drywall.



IV. Leakage Between Units (For Consideration)

Using guarded blower door tests to isolate air leakage between units, we have observed up to 300 cfm of leakage between units and through the fire separation wall. The techniques describe in Section III above will significantly reduce this unit to unit transfer. Though air movement from conditioned to conditioned space does not significantly impact energy usage, it may have adverse effects on occupant comfort and indoor air quality. Cigarette smoke and cooking odors still have the possibility of traversing the fire separation wall and dispersing through the floor system. Leakage through the separation wall can be treated with fire rated caulk and/or drywall slurry, but it is recommend that you consult your manufacturer to ensure this does not impact the total UL of the assembly.



References & Important Links

- Duke Energy Progress New Construction Program
<https://www.duke-energyrncinfo.com>
- Building America Solution Center
<https://basc.pnnl.gov/>
- ENERGY STAR Certified New Homes
<https://www.energystar.gov/newhomes>
- Building Science Corporation
<https://buildingscience.com/>

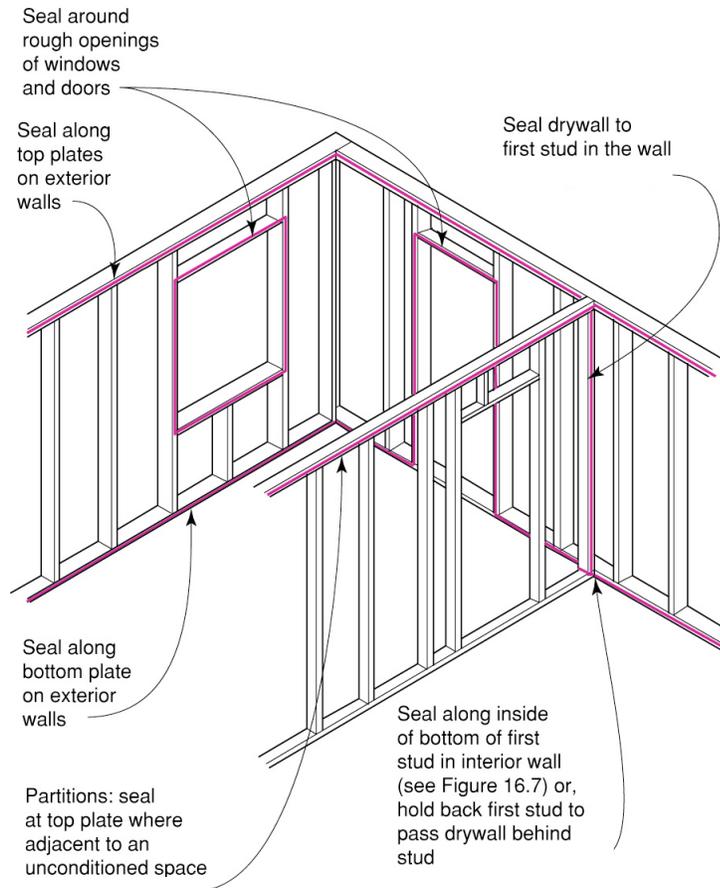
1 Appendix

1. Air Barriers – Airtight Drywall Approach for all Climates, Building Science Corporation
2. ENERGY STAR Rater Design Review Checklist (Section 4)

Air Barriers—Airtight Drywall Approach

for All Climates

Sealing Perimeter of Drywall Assemblies



Air Barriers—Airtight Drywall Approach

Gypsum board drywall is, itself, a suitable air barrier material. The taping of drywall seams results in a plane of airtightness at the field of the wall. However, several steps must be taken to use this material property to create a continuous and complete air barrier system. To do this, it is important to create air barrier continuity at the perimeter of drywall assemblies, at all penetrations through the drywall, and, finally, in areas of the enclosure without interior drywall.

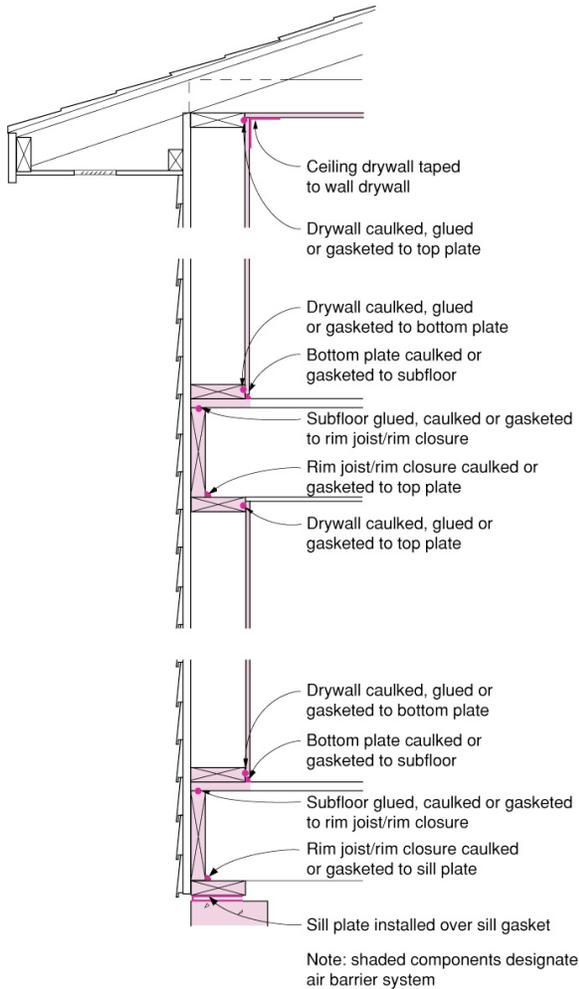
Drywall Assembly Perimeter

Air barrier continuity at the perimeter of drywall assemblies is achieved by sealing the edges of the drywall to solid framing materials. This requires a continuous bead of sealant along:

- all exterior wall bottom and top plates,
- all top plates at insulated ceilings,
- rough opening perimeters, and
- both sides of the first interior stud of partition walls.

The air seal at the partition wall intersection is shown in greater detail below.

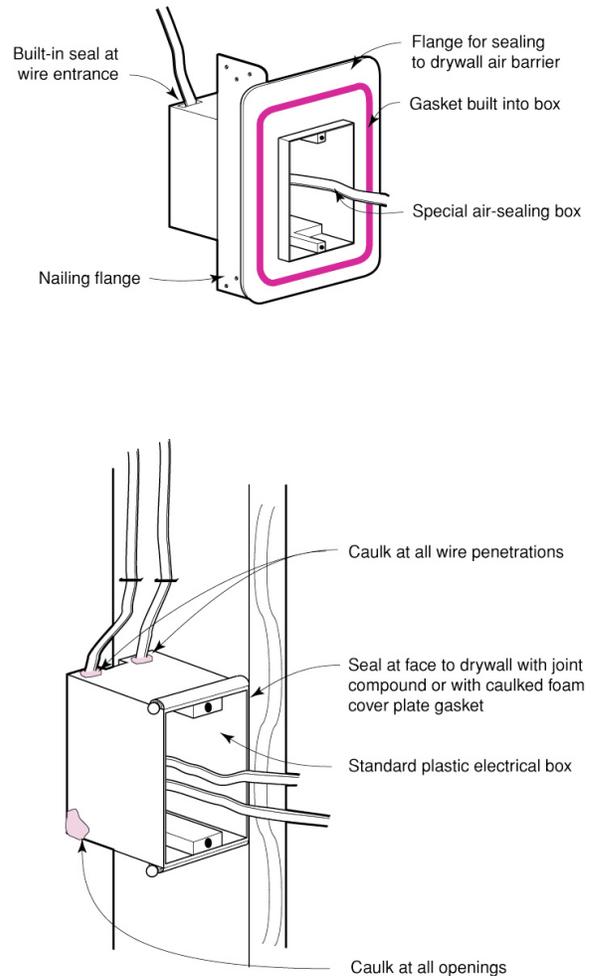
Airtight Drywall Approach – Interior Air Barrier Using Drywall and Framing



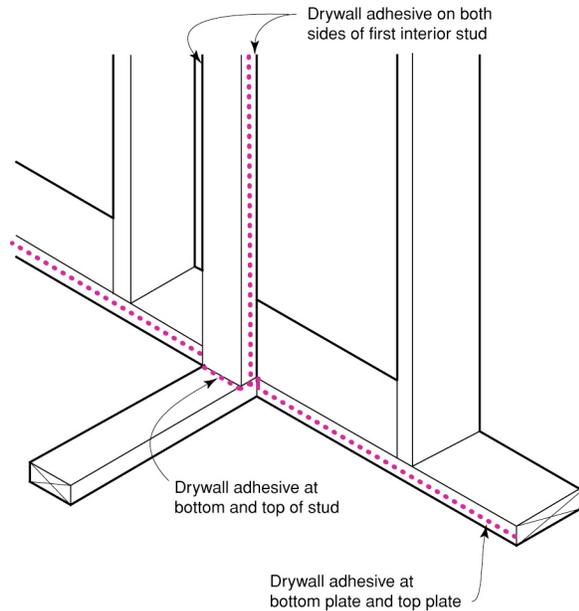
Penetrations of Drywall Assemblies

Typical penetrations in exterior wall and ceiling drywall assemblies include electric penetrations – electric boxes and recessed fixtures. Electric boxes can be made air tight by caulking or sealing all openings in the box (including around wire penetrations) and by sealing the face of the box to the drywall. Specially designed airtight electric boxes with flexible boot seals at wire penetrations and a gasketed flange at the face can also provide air barrier continuity.

Electric Box Penetrations

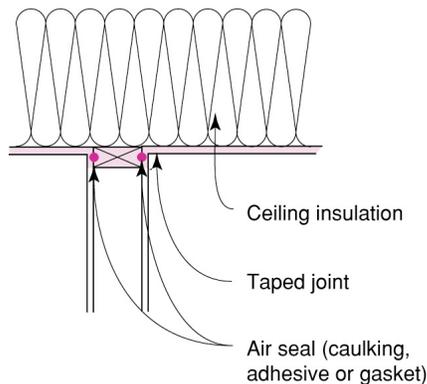


Air Sealing at Partition



- Adhesive at bottom and top of partition stud allows air barrier to transition uninterrupted to other side of partition
- Penetrations through first partition stud must also be sealed

Top Plate with Unconditioned Space Above



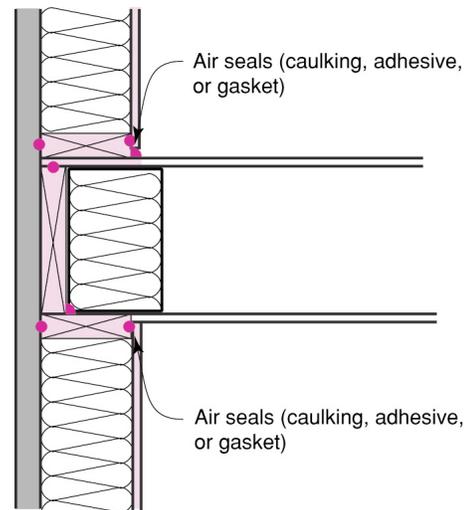
- Penetrations through top plate must also be sealed

Recessed ceiling fixtures in insulated ceiling should be both insulation contact (“IC”)- and air tight rated. The housing of the recessed fixture should also be sealed (with caulk or an effective gasket) to the ceiling gypsum board.

Structural Framing Air Barrier Transitions

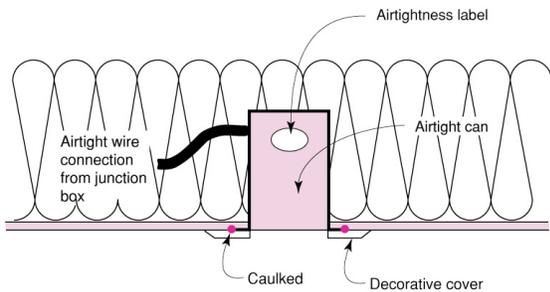
Obviously, drywall cannot provide an air barrier where it is absent. The diagrams below and to the right show how the air barrier continuity is maintained through the framing at rim joist/band joist areas. These measures form a necessary complement to drywall sealing in the airtight drywall approach. Refer to other Information Sheets for air sealing details at other common conditions. The resources listed below also illustrate air sealing details and provide further discussion.

Intersection of Floor Joists and Exterior Wall



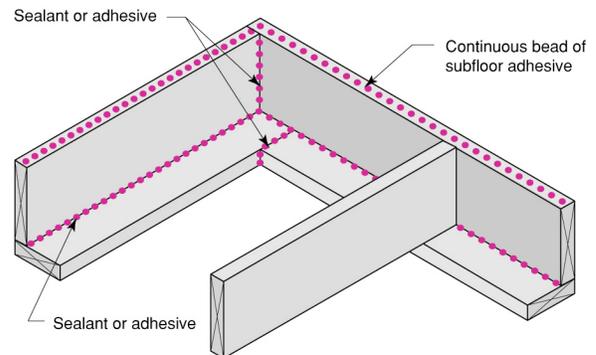
- Drywall sealed to top and bottom plates
- Bottom plate sealed to subfloor
- Subfloor sealed to rim closure board
- Rim closure board sealed to top plate

Recessed Fixture in Insulated Ceiling



- Fixture labeled IC-rated and airtight as determined by ASTM E-283 air leakage test
- Housing (not decorative trim piece) sealed to ceiling with caulk or gasket

Air Barrier Continuity at Rim Joist/Band Joist



- Continuous fillet bead applied at bottom of rim closure board
- Continuous bead of adhesive applied to top of rim closure board
- Sealant applied at all butt joints in rim closure board and sill plate/top plate
- Spray foam may also be used to seal between the sill/top plate, rim/band joist, and floor deck. Note that joints in the sill/top plate may not be sealed by the foam application.

Suggestions for Further Research:

“Understanding Air Barriers”, Building Science Digest-104, www.buildingscience.com.

“READ THIS: Before You Design, Build, or Renovate,” Building Science Primer-040, www.buildingscience.com.

Lstiburek, Joseph W.; *Builder's Guide Series*, Building Science Press, 2006.



Rater Field Checklist

ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

Home Address: _____ City: _____ State: _____ Permit Date: _____

Thermal Enclosure System	Must Correct	Builder Verified ¹	Rater Verified ²	N/A ³
1. High-Performance Fenestration & Insulation				
1.1 Fenestration meets or exceeds levels specified in Item 2.1 of the Rater Design Review Checklist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.2 Insulation meets or exceeds levels specified in Item 3.1 of the Rater Design Review Checklist	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
1.3 All insulation achieves RESNET-defined Grade I installation. See Footnote 4 for alternatives. ⁴	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
2. Fully-Aligned Air Barriers⁵ At each insulated location below, a complete air barrier is provided that is fully aligned as follows:				
<u>Ceilings:</u> At interior or exterior horizontal surface of ceiling insulation in Climate Zones 1-3; at interior horizontal surface of ceiling insulation in Climate Zones 4-8. Also, at exterior vertical surface of ceiling insulation in all climate zones (e.g., using a wind baffle that extends to the full height of the insulation in every bay or a tabbed baffle in each bay with a soffit vent that prevents wind washing in adjacent bays). ⁶				
2.1 Dropped ceilings / soffits below unconditioned attics, and all other ceilings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
<u>Walls:</u> At exterior vertical surface of wall insulation in all climate zones; also at interior vertical surface of wall insulation in Climate Zones 4-8 ⁷				
2.2 Walls behind showers, tubs, staircases, and fireplaces	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
2.3 Attic knee walls and skylight shaft walls ⁸	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
2.4 Walls adjoining porch roofs or garages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
2.5 Double-walls and all other exterior walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
<u>Floors:</u> At exterior vertical surface of floor insulation in all climate zones and, if over unconditioned space, also at interior horizontal surface including supports to ensure alignment. See Footnotes 10 & 11 for alternatives. ^{9, 10, 11}				
2.6 Floors above garages, floors above unconditioned basements or crawlspaces, and cantilevered floors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
2.7 All other floors adjoining unconditioned space (e.g., rim / band joists at exterior wall or at porch roof)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3. Reduced Thermal Bridging				
3.1 For insulated ceilings with attic space above (i.e., non-cathedralized), Grade I insulation extends to the inside face of the exterior wall below and is $\geq R-21$ in CZ 1-5; $\geq R-30$ in CZ 6-8 ¹²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.2 For slabs on grade in CZ 4-8, 100% of slab edge insulated to $\geq R-5$ at the depth specified by the 2009 IECC and aligned with the thermal boundary of the walls ^{13, 14}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.3 Insulation beneath attic platforms (e.g., HVAC platforms, walkways) $\geq R-21$ in CZ 1-5; $\geq R-30$ in CZ 6-8	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4 At above-grade walls separating conditioned from unconditioned space, one of the following options used (rim / band joists exempted): ¹⁵				
3.4.1 Continuous rigid insulation, insulated siding, or combination of the two is: $\geq R-3$ in CZ 1-4; $\geq R-5$ in CZ 5-8 ^{16, 17, 18} OR ;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.2 Structural Insulated Panels OR ; Insulated Concrete Forms OR ; Double-wall framing OR ; ^{16, 19}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.3 Advanced framing, including all of the Items below: ²⁰				
3.4.3a Corners insulated $\geq R-6$ to edge ²¹ , AND ;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.3b Headers above windows & doors insulated $\geq R-3$ for 2x4 framing or equivalent cavity width, and $\geq R-5$ for all other assemblies (e.g., with 2x6 framing) ²² , AND ;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.3c Framing limited at all windows & doors to one pair of king studs, plus one pair of jack studs per window opening to support the header and sill, AND ;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.3d Interior / exterior wall intersections insulated to same R-value as rest of exterior wall, ²³ AND ;	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
3.4.3e Minimum stud spacing of 16 in. o.c. for 2x4 framing in all Climate Zones and, in CZ 6-8, 24 in. o.c. for 2x6 framing ²⁴	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
4. Air Sealing (Unless otherwise noted below, "sealed" indicates the use of caulk, foam, or equivalent material)				
4.1 Ducts, flues, shafts, plumbing, piping, wiring, exhaust fans, & other penetrations to unconditioned space sealed, with blocking / flashing as needed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
4.2 Recessed lighting fixtures adjacent to unconditioned space ICAT labeled and gasketed. Also, if in insulated ceiling without attic above, exterior surface of fixture insulated to $\geq R-10$ in CZ 4-8.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.3 Above-grade sill plates adjacent to conditioned space sealed to foundation or sub-floor. Gasket also placed beneath above-grade sill plate if resting atop concrete / masonry & adjacent to cond. space ^{25, 26}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.4 Continuous top plate or blocking is at top of walls adjoining unconditioned space, and sealed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.5 Drywall sealed to top plate at all unconditioned attic / wall interfaces using caulk, foam, drywall adhesive (but not other construction adhesives), or equivalent material. Either apply sealant directly between drywall and top plate or to the seam between the two from the attic above.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.6 Rough opening around windows & exterior doors sealed ²⁷	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
4.7 Walls that separate attached garages from occupiable space sealed and, also, an air barrier installed and sealed at floor cavities aligned with these walls	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.8 In multifamily buildings, the gap between the common wall (e.g. the drywall shaft wall) and the structural framing between units sealed at all exterior boundaries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.9 Doors adjacent to unconditioned space (e.g., attics, garages, basements) or ambient conditions made substantially air-tight with weatherstripping or equivalent gasket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	-
4.10 Attic access panels, drop-down stairs, & whole-house fans equipped with durable $\geq R-10$ cover that is gasketed (i.e., not caulked). Fan covers either installed on house side or mechanically operated. ²⁸	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>