## APPENDIX A

### AIR SEALING KEY POINTS

#### Air Barrier and Insulation Inspection Component Guide

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>COMPONENT</th>
<th>CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Air barrier and thermal barrier</td>
<td>Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material. Air-permeable insulation is inside of an air barrier.</td>
</tr>
<tr>
<td>2</td>
<td>Ceiling/attic</td>
<td>Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.</td>
</tr>
<tr>
<td>3</td>
<td>Walls</td>
<td>Corners and headers are insulated. Junction of foundation and sill plate is sealed.</td>
</tr>
<tr>
<td>4</td>
<td>Windows and doors</td>
<td>Space between window/door jambs and framing is sealed.</td>
</tr>
<tr>
<td>5</td>
<td>Rim joints</td>
<td>Rim joints are insulated and include an air barrier.</td>
</tr>
<tr>
<td>6</td>
<td>Floors (including above-garage and cantilevered floors)</td>
<td>Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.</td>
</tr>
<tr>
<td>7</td>
<td>Crawl space walls</td>
<td>Insulation is permanently attached to walls. Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped.</td>
</tr>
<tr>
<td>8</td>
<td>Shafts, penetrations</td>
<td>Duct shafts, utility penetrations, knee walls and flue shafts opening to exterior or unconditioned space are sealed.</td>
</tr>
<tr>
<td>9</td>
<td>Narrow cavities</td>
<td>Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.</td>
</tr>
<tr>
<td>10</td>
<td>Garage separation</td>
<td>Air sealing is provided between the garage and conditioned spaces.</td>
</tr>
<tr>
<td>11</td>
<td>Recessed lighting</td>
<td>Recessed light fixtures are air tight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.</td>
</tr>
<tr>
<td>12</td>
<td>Plumbing and wiring</td>
<td>Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.</td>
</tr>
<tr>
<td>13</td>
<td>Shower/tub on exterior wall</td>
<td>Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.</td>
</tr>
<tr>
<td>14</td>
<td>Electrical/phone box on exterior walls</td>
<td>Air barrier extends behind boxes or air sealed-type boxes are installed.</td>
</tr>
<tr>
<td>15</td>
<td>Common wall</td>
<td>Air barrier is installed in common wall between dwelling units.</td>
</tr>
<tr>
<td>16</td>
<td>HVAC register boots</td>
<td>HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.</td>
</tr>
<tr>
<td>17</td>
<td>Fireplace</td>
<td>Fireplace walls include an air barrier.</td>
</tr>
</tbody>
</table>

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Air sealing key points

1. Seal airtight IC-rated recessed light fixtures to drywall
2. Fan vented through exterior wall sealed at penetration
3. Insulate and install sheet material behind bathtub
4. Insulate headers
5. Insulate corners
6. Insulated exterior wall
7. Window sealed into rough opening using backer rod
8. Seal plumbing penetrations (if ceiling is insulated)
9. Narrow stud cavity batts are cut to fit
10. Seal gap between electrical box and drywall
11. Seal wiring and plumbing penetrations
12. Electrical panel box, recommend install on interior (non-insulated) wall. If installed on exterior wall, air barrier shall extend behind box or air-sealed box shall be installed.

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Appendix A

Air sealing key points continued

Chases and common by-passes

1. Seal top plate
2. Cap top of chase with solid air barrier and insulate above dropped soffit
3. Install air barrier on interior of all insulated walls

1. Seal chases
2. Caulk electrical boxes and fixtures to drywall

14. 12. Seal electrical penetrations
16. Seal HVAC penetrations
15. Seal penetrations in common wall
13. Install insulation and sealed air barrier behind tub (required)
12. Seal bathtub drain penetration
3. Seal bottom plate

Shower/tub drain rough opening

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Air sealing key points continued

Window rough opening

Use backer rod or spray foam (appropriate for windows) to fill gaps between window/door and rough opening

Wall cross-section

1. Glue drywall to top and bottom plates (recommended)

2. Sill gasket or double-bead of caulk under bottom plate

3. Insulation is permanently attached to walls

4. Sealed CLASS I vapor retarder required in crawlspace

5. Caulk band joint to subfloor and plates

6. Underfloor insulation must be installed in permanent contact with subfloor (air barrier required at any exposed edge of insulation)

7. Install exterior water resistant barrier as per IRC 703.2

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Air sealing key points continued

Combustion chase penetrations

Combustion closet

Combustion air inlets

as per mechanical and/or fuel gas code

Rigid foam option (recommend covering with ignition barrier for fire protection)

Internal air barrier (recommended)

Seal around chimney flues with sheet metal cap

Seal

Flue stack

Seal gas and plumbing penetrations through walls

Insulated walls (not required unless walls are part of building thermal envelope)

Insulated water heater (not required)

Door closes against solid threshold

Bottom plate sealed

Solid (non-louvered) door with weatherstripping

Blocking above supporting wall for cantilevered floor (required)

Seal

Underfloor insulation must be installed in permanent contact with subfloor (air barrier required at any exposed edge of insulation)

Insulation above top plate of supporting wall

Externeer:
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Exterior penetrations

Caulk exterior wall penetrations for refrigeration lines, condensate line, etc.
Air sealing key points continued

1. Install blocking and rafter baffle to prevent wind washing if vented, insulated roofline (required)

2. Sealed attic-side air barrier (required)—OSB, insulated sheathing, etc.

3. Blocking - fit in joist cavity, caulked or foamed

Attic knee-walls

Rigid insulation (recommended)
Minimum R-5 (Georgia requirement)

Weather-stripping door opening and threshold

2. Caulk and seal rough opening

Two-level attic

Unconditioned Space
Air barrier required,
(rigid insulation board recommended)

1. Attic knee-wall requires R-18 insulation
(Georgia requirement)

Caulk

Glue

Conditioned space

Conditioned Space

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Air sealing key points continued

Attic scuttle

Insulation dams prevent loose-fill insulation from falling through access
Hatch lid pushes up and out of the way for access
Rigid insulation plus batt (recommended), minimum R-19 (Georgia requirement)

Attic pull-down stairs

Rigid insulation box forms lid for pull-down attic staircase (recommended)
Insulation dams prevent loose-fill insulation from falling through access
Cover box pushes up and out of the way for access
Minimum R-5 (Georgia requirement)
Weatherstripping
Panel
Seal gap between frame and rough opening with caulk, backer rod, or foam

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Appendix A

Air sealing key points

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Additional Multifamily Air-sealing Keypoints

1. Cap and seal all chases including chases for grouped utility lines and radon vents
2. Seal penetrations in mechanical closet including penetrations for the:
   a. supply plenum
   b. outside air ventilation
   c. refrigerant line
   d. plumbing
   e. electrical
   f. gas fuel
3. Seal band area at exterior sheathing side and all penetrations through band
4. Air seal at drywall finishing for any wall adjacent to stairwell or elevator. Air seal this gap at every change in floor level
5. Seal miscellaneous clustered penetrations through building envelope (e.g. refrigerant lines)

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Air sealing key points continued

Mechanical Closet

- Seal electrical and plumbing penetrations and perimeter of outside air ventilation duct
- Utility chase capped and sealed at perimeter - at all levels
- Seal plenum penetration through drywall
- Seal refrigerant penetration
- Seal plumbing penetration
- Seal perimeter of drain penetration

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Air sealing key points continued

Multifamily

- Seal gap between levels
- Cavity insulation plus exterior sheathing
- Seal penetrations through exterior sheathing
- Recommend rigid foam between concrete masonry units and framed stud wall
  - Steel framing requirements
    - R-5 foam required if steel studs
    - R-7.5 if greater than 3 stories

Seal gap between concrete wall and framed units at each level

FRAMED MULTI-STORY LIVING UNITS

CONCRETE MASONRY UNIT STAIRWELL or ELEVATOR CHASE

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Building Thermal Envelope — The basement walls, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space. — 2009 IECC

The building thermal envelope is the barrier that separates the conditioned space from the outside or unconditioned spaces. The building envelope consists of two parts – an air barrier and a thermal barrier that must be both continuous and contiguous (touching each other).

In a typical residence, the building envelope consists of the roof, walls, windows, doors, and foundation. Examples of unconditioned spaces include attics, vented crawlspaces, garages, and basements with ceiling insulation and no HVAC supply registers.

Example 1
- Attic
- Conditioned space
- Garage
- Basement/vented crawlspace

Example 2
- Vaulted conditioned space
- Attic
- Important air sealing location
- Baseline conditioned or indirectly-conditioned

Example 3
- Indirectly-conditioned space

This is a conventional approach that likely locates all ductwork in unconditioned spaces.

Example $R$-values
1. Flat ceiling: R-30
2. Exterior walls: R-13 + R-3 sheathing
3. Floor over garage and basement/crawl: R-19
4. Ductwork sealed with mastic and insulated to R-8 in attic, R-6 in basement/crawlspace
5. Garage, attic and basement/crawl are unconditioned spaces

If supply registers deliver conditioned air to basement, it is considered conditioned. With no supply air, it is considered an indirectly-conditioned space.

Example $R$-values
1. Flat ceiling: R-38
2. Kneewalls: R-18 (required) (R-13+ R-5, R-15 + R-3, R-19 in 2x6)
3. Vaulted ceiling: R-19 air-permeable insulation plus R-5 rigid foam board
4. Exterior walls: R-13
5. Basement masonry walls: R-5
6. Basement slab: R-0
7. Ductwork sealed with mastic and insulated to R-8 in attic, R-6 in basement
8. Garage and attic are unconditioned spaces

The top conditioned floor functions as a vaulted ceiling with interior walls although it appears to have kneewalls and a flat ceiling. An advantage of this approach is that all upstairs ductwork is located inside the building envelope.

The crawlspace walls are insulated and do not contain vents. The crawlspace ground is covered with concrete or 100% plastic and functions as a 'mini-basement.'

Example $R$-values
1. Vaulted ceiling: R-19 air-impermeable foam insulation
2. Exterior walls: R-13 + R-3 sheathing
3. Crawlspace walls: R-5
4. Ductwork insulated with mastic and insulated to R-6
5. Garage is unconditioned space

1 $R$-values shown are examples and not code requirements. Refer to table 402.1.1 for specific prescriptive insulation requirements.
2 An attic kneewall is any vertical wall that separates conditioned space from an unconditioned attic.
3 In Georgia, kneewalls must be insulated to R-18. A sealed attic-side air barrier (OSB, foil-faced sheathing, etc.) is required when using air permeable insulation.
4 Requires trade-off (such as RES/cool) since prescriptive ceiling requirement is R-30 / R-38, see routine installed insulation options and section 606.4 of the 2006 IRC.
5 Slab insulation is not required in Georgia due to termite risk.

Although there is nothing to prevent the garage walls from being insulated, due to indoor air quality concerns, the garage should never be considered inside the building envelope.
Insulation Details for Ceilings with Attic spaces
Rafter and Truss

Standard Truss with tapered insulation depth

Energy Truss with full height insulation (recommended)

Standard rafter and top plate with tapered insulation depth

Rafter on raised top plate with full height insulation (recommended)

Note: Wind wash baffle and air-permeable insulation dam. For air permeable insulation in unvented attics, baffles shall be installed adjacent to soffit and eave vents. A minimum of a 1-inch of space shall be provided between the insulation and the roof sheathing and at the location of the vent. The baffle shall extend over the top of the insulation inward until it is at least 4 inches vertically above the top of the insulation. Any solid material such as cardboard or thin insulating sheathing shall be permissible as the baffle.

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Roofline Installed Insulation Options

*Reference Table 402.1.4 in Georgia amendments to the 2009 IECC and Section 806.4 “unvented attic assemblies” in the Georgia Amendments to the 2006 IRC*

**Air impermeable installed insulation**
- *(e.g., spray foam insulation)*
  - Shingles
  - Roofing felt
  - Decking
  - Air impermeable insulation
    - *(e.g., open- or closed-cell spray foam)*
  - Air impermeable insulation
    - *(Georgia requirements)*
  - Air impermeable insulation
    - *(R-19 minimum if trade-offs are used)*

**Air-permeable installed insulation**
- *(e.g., fiberglass, cellulose)*
  - Shingles
  - Roofing felt
  - Decking
  - Air-permeable insulation
  - Air-impermeable insulation
    - *(e.g., rigid foam board)*
    - R-5 minimum in climate zones 2 & 3
    - R-15 minimum in climate zone 4
  - Air-impermeable insulation
    - *(Georgia requirements)*

**Option 1**
- Air impermeable insulation
  - *(e.g., rigid foam board)*
- Air-impermeable insulation
  - *(R-15 minimum in climate zone 4)*

**Option 2**
- Air impermeable insulation
  - *(e.g., rigid foam board)*
- Air-impermeable insulation
  - *(R-15 minimum in climate zone 4)*

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