



## BUILDING AMERICA TOP INNOVATIONS HALL OF FAME PROFILE

INNOVATIONS CATEGORY:

- 4. Infrastructure Development
- 4.3 Informing Code / Standards Process

# Thermal Bypass Air Barriers in the 2009 International Energy Conservation Code

Imagine Homes of San Antonio, Texas, worked with Building America team partner IBACOS to improve the continuity of the air barrier along the thermal enclosure by using spray foam insulation in the walls and attic.

Since complete Thermal Bypass Air Barrier requirements were adopted in the 2009 IECC, close to one million homes have been mandated to include this vitally important energy efficiency measure.

*Building America research teams effectively demonstrated the importance of thermal bypass air barriers, which led to their inclusion in ENERGY STAR for Homes Version 2 specifications in 2006 and then to inclusion in the 2009 IECC. This is a great example of effective research driving a complete market transformation process for a critical high-performance home innovation.*

Air sealing of the home's thermal enclosure has been required by the energy code for many years. However, in years past, the provisions were somewhat vague and only required that critical areas of potential air leakage (e.g., joints, seams, penetrations, and shafts) be sealed with a durable material such as caulking, gasketing, or weather stripping. Since air leakage is so critical to home performance, Building America research consistently focused on promoting better air sealing and air barrier details. This included field studies demonstrating the ease and cost-effectiveness for production builders to include a comprehensive package of stringent air sealing and air barrier details.

In 2006, ENERGY STAR for Homes Version 2 specifications followed Building America's lead and mandated a Thermal Bypass Checklist addressing the key air barrier details. The success of that checklist then paved the way for a similar list of air barriers to be adopted by the 2009 International Energy Conservation Code (IECC).

The 2009 IECC requires verification of air sealing by either a visual inspection against a detailed checklist or a whole-house pressure test (i.e., a blower door test). The 2012 IECC changed the requirement to make both the visual inspection and the pressure testing mandatory for all new homes. The 2009 IECC limits air leakage to less than 7 air changes per hour at 50 Pascals. The 2012 IECC lowers the maximum allowed air leakage limits to  $\leq 5$  ACH 50 in IECC Climates Zones 1 and 2, or  $\leq 3$  ACH 50 in Climate Zones 3 through 8 (BECP 2011).

The air leakage requirements described in the 2009 IECC Section 402.4 (and 2009 IRC Chapter 11) include a full list of air barrier details. This section states "the building thermal envelope shall be durably sealed

### Maximum Allowed Air Leakage

(as tested with a blower door test)

Climate Zone	2009 IECC	2012 IECC
1 - 2	< 7 ACH	$\leq 5$ ACH @ 50 pascals
3 - 8	< 7 ACH @ 50 pascals	$\leq 3$ ACH @ 50 pascals



### BUILDING AMERICA TOP INNOVATIONS

**Recognizing Top Innovations in Building Science** - The U.S. Department of Energy's Building America program was started in 1995 to provide research and development to the residential new construction and remodeling industry. As a national center for world-class research, Building America funds integrated research in market-ready technology solutions through collaborative partnerships between building and remodeling industry leaders, nationally recognized building scientists, and the national laboratories. Building America Top Innovation Awards recognize those projects that have had a profound or transforming impact on the new and retrofit housing industries on the road to high-performance homes.

to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weather stripped or otherwise sealed with an air barrier material, suitable film, or solid material: 1) all joints, seams and penetrations, 2) site-built windows, doors, and skylights, 3) openings between window and door assemblies and their respective jambs and framing, 4) utility penetrations, 5) dropped ceilings or chases adjacent to the thermal envelope, 6) knee walls, 7) walls and ceilings separating a garage from conditioned spaces, 8) behind tubs and showers on exterior walls, 9) common walls between dwelling units, 10) attic access openings, 11) rim joists junction, 12) other sources of infiltration.”

Building America publications provide extensive guidance on air sealing and air barriers. Specific projects are reported in case studies found on the Building America website [www.buildingamerica.gov](http://www.buildingamerica.gov). Guides written by Building America researchers are also available through team and Building America websites. One example, “Air Barriers – Airtight Drywall Approach” (BSC 2006), covers caulking of drywall to framing and sealing around holes through the drywall. Research partner Building Science Corporation prepared a *Guide to Attic Air Sealing* that gives detailed guidance for air sealing 19 common sources of air leakage in attics, such as around flues and duct chases, at dropped soffits, over top plates, etc. The guide was written for existing homes; however, the guidance is also applicable to new construction in most situations. Building America also published *Air Sealing: A Guide for Contractors to Share with Homeowners* (Baechler et al. 2010). This is another guide written for retrofits where many of the recommendations are equally appropriate for builders seeking to meet the air sealing requirements of the 2009 IECC.

REFERENCES

**Baechler, MC, TL Gilbride, MG Hefty, PC Cole, JL Williamson, and PM Love.** 2010. *Air Sealing: A Guide for Contractors to Share with Homeowners*, PNNL-19284, prepared by Pacific Northwest National Laboratory for the U.S. Department of Energy Building America, [http://apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/ba\\_airsealing\\_report.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/ba_airsealing_report.pdf)

**BECP.** 2011. *Building Energy Code Resource Guide: Air Leakage Guide*, PNNL-SA-82900, U.S. Department of Energy Building Energy Codes Program, [www.energycodes.gov/sites/default/files/documents/BECP\\_Building%20Energy%20Code%20Resource%20Guide%20Air%20Leakage%20Guide\\_Sept2011\\_v00\\_lores.pdf](http://www.energycodes.gov/sites/default/files/documents/BECP_Building%20Energy%20Code%20Resource%20Guide%20Air%20Leakage%20Guide_Sept2011_v00_lores.pdf)

**BSC.** 2006. “Air Barriers – Airtight Drywall Approach,” BSC Information Sheet 401, Prepared by Building Science Corporation for the U.S. Department of Energy Building America [http://apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/airtight\\_drywall\\_approach.pdf](http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/airtight_drywall_approach.pdf)

**Lstiburek, J.** 2010. *Guide to Attic Air Sealing*, Prepared by Building Science Corporation for the U.S. Department of Energy Building America, [www.buildingscience.com/documents/guides-and-manuals/gm-attic-air-sealing-guide/view](http://www.buildingscience.com/documents/guides-and-manuals/gm-attic-air-sealing-guide/view)

Air Sealing Trouble Spots

(Baechler et al. 2010)

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| 1. Air Barrier and Thermal Barrier Alignment | 11. Ducts  |
| 2. Attic Air Sealing                         | 12. Whole-House Fan                              |
| 3. Attic Knee Walls                          | 13. Exterior Wall Penetrations                   |
| 4. Ceiling Penetration for Exhaust Fan       | 14. Fireplace Wall                               |
| 5. Dropped Ceiling/Soffit                    | 15. Garage/Living Space Interface                |
| 6. Staircase Framing at Exterior Wall        | 16. Cantilevered Floor                           |
| 7. Attic Knee Wall                           | 17. Rim Joists, Sill Plate, Foundation, Floor    |
| 8. Flue or Chimney Shaft                     | 18. Windows & Doors                              |
| 9. Attic Access                              | 19. Common Walls Between Attached Dwelling Units |
| 10. Recessed Lighting                        |  |

