



Building America Case Study Technology Solutions for New and Existing Homes

Preventing Thermal Bypass

Sarasota Springs, Florida

PROJECT INFORMATION

Location: South Sarasota County, FL

Partners:

Pacific Northwest National Laboratory
www.pnnl.gov

Energy Smart Home Plans
<http://www.energysmarthomeplans.com/>

Habitat for Humanity, South Sarasota
<http://www.habitatsouthsarasota.org/>

Building Component: Fully-aligned air and thermal barriers

Application: New, single-family

Size: 1,055 ft²

Year Tested: 2012

Climate Zone: Hot-Humid

PERFORMANCE DATA

Projected Whole House Energy Savings: 34% based on HERS 66 rating

Projected Whole-House Energy Cost Savings: \$29/month or \$345/year (based on HERS certificate)

Air Sealing and Alignment of Air and Thermal Barriers Required to Prevent Bypass

Thermal performance requires more than high R-value insulation – continuous air barriers in full alignment with insulation also play an important role in achieving energy performance. Thermal bypasses can increase energy use by allowing air currents to circumvent insulation. ENERGY STAR's Thermal Bypass Inspection Checklist provides a systematic way to close these gaps and must be completed before a home can receive the ENERGY STAR label.

Alignment of air and thermal barriers is among the most important elements of the checklist. Alignment means that insulation must be flush on all sides with structural lumber and gypsum board because any gaps, such as those created by inset stapling or the haphazard placement of insulation, result in potential pathways for convective air currents. Also, if the air barrier is not aligned with the insulation or has leaks in it, air can flow through the insulation, negating the purpose of thermal barrier. Even small gaps in the air barrier, such as seams in foam board or wiring penetrations, need to be sealed to prevent air from flowing through the gaps whenever pressure differences exist between the inside and outside of the home, or between conditioned and non-conditioned spaces, created by wind and temperature differences.

Building America partner Habitat for Humanity in South Sarasota County, Florida, built a single-family home in 2012 on a small budget using donated appliances that were not at ENERGY STAR levels. In addition to the Thermal Bypass Checklist, energy efficiency measures included the installation of a SEER 14 heat pump, R-7.8 rigid insulation in the attic, and 100% CFL lighting. Despite the budget challenges, the 1,055-square-foot, slab-on-grade home reached 66 on the HERS Index through the combined effect of all of the measures.

Volunteer professional builders attached rigid polyisocyanurate insulation to the interior face of concrete block walls by nailing furring strips to the interior surface of the insulation. Insulation was installed before any interior framing was added to avoid thermal breaks where interior walls intersect the insulation.

Installing Batt Insulation – The Right and the Wrong Way

Both insulation methods do a good job of avoiding gaps from ill-fitting pieces.

Right

EPA's Thermal Bypass Checklist requires alignment between the thermal and air barriers. One technique is to staple the insulation to the joist faces as shown in the picture below.



Wrong

In the picture below, inset stapling of batt insulation to the sides of studs leaves gaps between the thermal barrier (insulation) and the air barrier (drywall). These gaps create cold spots on walls and pathways for air currents that pull air through leaks in air barriers.



In many cases a properly installed thermal barrier can be compromised by holes or gaps in the air barrier. One approach to ensure the integrity of the air and thermal barrier is to delegate responsibility to one person to verify that air sealing is complete. While some builders may require electrical and plumbing teams to fill their own holes, this project found it effective to have one person follow these teams and ensure that all holes were properly sealed.

Lessons Learned

- Using low-cost measures, Habitat for Humanity achieved a HERS of 66. If ENERGY STAR appliances could have been used, the rating would have been even better.
- After on-site training for best practice procedures for air sealing and face stapling of batt insulation, professional installers readily picked up these methods.
- Assigning one person on a job site to verify that air sealing was completed ensured the integrity of the thermal and air barrier and achieved energy savings by preventing thermal bypasses.
- Fully-aligned air and thermal barriers help maximize the energy efficiency of the building envelope and minimize utility bills, which is especially important for Habitat's low-income clients. The U.S. EPA estimates that air sealing and fully aligned air barriers can save 15% on heating and cooling costs.¹ These increases in energy efficiency are achieved for \$0 additional material costs and minimal additional labor.

Looking Ahead

As the number of ENERGY STAR homes increases, the program's Thermal Bypass Checklist will become more prominent. According to the Building Energy Codes Program at Pacific Northwest National Laboratory, Florida energy codes approximate the 2009 International Energy Conservation Code, which requires that builders meet an extensive air sealing checklist. The 2012 IECC will require that builders meet stringent air sealing as verified with blower door testing. A complete and fully aligned air barrier will be an important part of meeting the new IECC performance-based air leakage requirements.

"It's great to build affordable homes. But more importantly, our homes must be affordable to operate."

*Michael Sollitto
Construction Manager
Habitat for Humanity
South Sarasota Springs*

¹ U.S. Environmental Protection Agency. "ENERGY STAR Qualified Homes, Version 3 Savings & Cost Estimate Summary." Available at: http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/EstimatedCostandSavings.pdf