Building America Case Study
Technology Solutions for New and Existing Homes

Buried and Encapsulated Ducts

Jacksonville, Florida

PROJECT INFORMATION

Project Name: Buried and Encapsulated Ducts

Location: Jacksonville, FL

Partners:

BASF
http://www.basf.com

Consortium for Advanced Residential Buildings
www.carb-swa.com

Building Component: Ductwork and Attic Insulation

Application: New and/or Retrofit; Single-Family

Year Tested: 2010-2011

Applicable Climate Zone(s): All Climates in IECC Moisture Regime A.

PERFORMANCE DATA

Cost of Energy-Efficiency Measure (including labor): $2,439

Projected Energy Savings: 34% cooling and heating savings

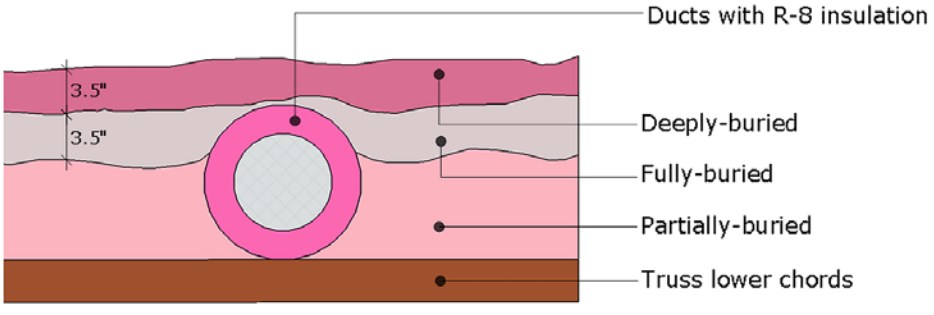
Projected Energy Cost Savings: $11/month or $135/year

Building America SM
U.S. Department of Energy

Ductwork installed in unconditioned attics can significantly increase the overall heating and cooling costs of residential buildings. In fact, estimated duct thermal losses for single-family residential buildings with ductwork installed in unconditioned attics range from 10% to 45%. In a study of three single-story houses in Florida, the Building America research team Consortium for Advanced Residential Buildings (CARB) investigated the strategy of using buried and/or encapsulated ducts (BED) to reduce duct thermal losses in existing homes.

The BED strategy consists of burying ducts in loose-fill insulation and/or encapsulating them in closed cell polyurethane spray foam (ccSPF) insulation. There are three possible combinations of BED strategies: (1) buried ducts; (2) encapsulated ducts (with ccSPF); and (3) buried and encapsulated ducts. The best solution for each situation depends on the climate, age of the house, and the configuration of the HVAC system and attic. For new construction projects, the team recommends that ducts be both encapsulated and buried as the minimal planning and costs required for this will yield optimal energy savings. The encapsulated/buried duct strategy, which utilizes ccSPF to address condensation concerns, is an approach that was developed specifically for humid climates.

Buried and BEDs are classified into three categories based on the distance from the top of the duct (or ccSPF) to the top of the loose-fill insulation: (1) partially buried; (2) fully buried; and (3) deeply buried (see figure below).



ENCAPSULATED DUCTS

Encapsulated ducts involve spraying ductwork with ccSPF insulation to boost the R-value of the duct insulation and reduce air leakage. Although ccSPF may be applied directly to the exterior of un-insulated ductwork, insulation of ductwork with fiberglass duct wrap prior to encapsulation is a lower cost way to increase the duct R-value. Spray foams specifically rated for exposed applications must be used.

DEEPLY BURIED DUCTS

After installation, deeply buried ducts will no longer be visible from the attic. The large R-values of the attic insulation will reduce lateral heat transfer to or from the ductwork.

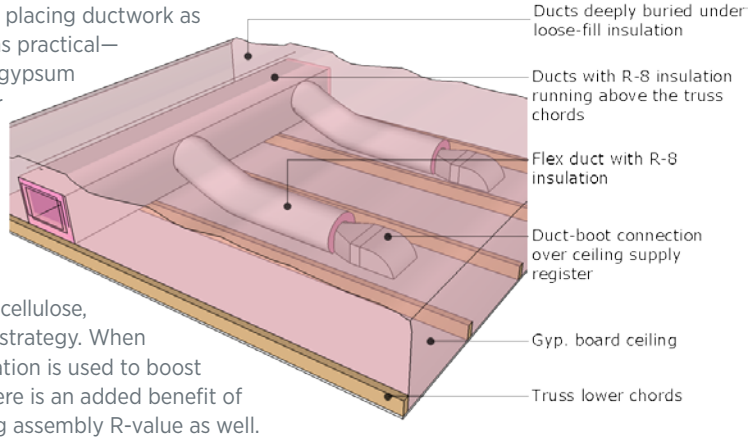
Looking Ahead

While BEDs show considerable promise for reducing ductwork thermal losses, more effort is needed to push this practice into mainstream building practices.

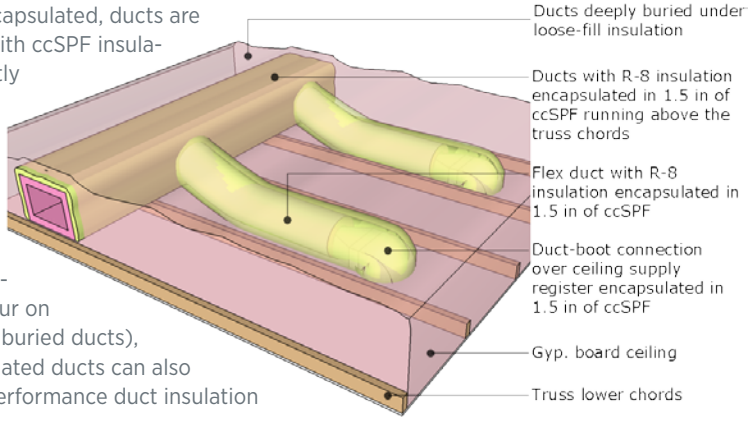
For more information, see the Building America report, *Measure Guideline: Buried and/or Encapsulated Ducts,* at *www.buildingamerica.gov*

Image credit: All images were created by the CARB team.

Buried ducts involve placing ductwork as close to the ceiling as practical—either on top of the gypsum board ceiling or over the truss bottom cords—and burying the ductwork beneath loose-fill insulation. Any loose-fill insulation, such as fiberglass or cellulose, can be used for this strategy. When more loose-fill insulation is used to boost the duct R-value, there is an added benefit of increasing the ceiling assembly R-value as well.



With buried and encapsulated, ducts are first encapsulated with ccSPF insulation and subsequently buried under loose-fill insulation. Initially conceived as a way to apply the buried ducts concept to humid climates (where condensation could occur on the outer surface of buried ducts), buried and encapsulated ducts can also be used as a high-performance duct insulation strategy in all climates.



Lessons Learned

- Buried, unencapsulated ducts should not be installed in moist or marine climates because of the risk of condensation of the surface of the ductwork.
- Encapsulating ductwork with 1.5 in. of ccSPF prior to burial will mitigate condensation concern.
- Spray foams can be installed in attics as long as an appropriate ignition barrier is used. Loose-fill fiberglass installed at least 1.5 in. over the top of the ccSPF qualifies as an ignition barrier.
- Spray foams may be left exposed in attics so long as they are specifically rated for exposed applications.
- BEDs have even higher R-values than buried ducts and include the air sealing benefits of encapsulated ducts.
- Properly installed BEDs have energy savings approaching true inside-conditioned space ducts installations.

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