Building America Case Study
Technology Solutions for New and Existing Homes

Buried and Encapsulated Ducts
Jacksonville, Florida

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.

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.