BUILDING AMERICA TOP INNOVATIONS 2013 PROFILE

INNOVATIONS CATEGORY:
1. Advanced Technologies and Practices
1.1 Building Science Solutions

TOP INNOVATOR:
CARB

Buried and Encapsulated Ducts

Poorly insulated ducts can result in thermal losses of 10% to 45% of total space conditioning energy use. Building America research indicates that properly installed buried ducts can reduce thermal losses to 3% or less. They are equally suitable for new construction and retrofits, making them applicable to tens of millions of homes.

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.

Building America U.S. Department of Energy

This Building America-developed technique allows ducts installed in a vented attic to meet the code requirements for ducts in conditioned space.

For years builders have designed their homes with the HVAC ducts in the attic. There is plenty of space up there to run the ducts and if the air handler is located in the attic as well, it's not taking up valuable square footage inside the home. The only problem is uninsulated attics can be very hot in the summer and very cold in the winter. Estimated thermal losses through ducts installed in unconditioned attics range from 10% to 45%, contributing significantly to homeowners' heating and cooling costs.

The Consortium for Advanced Residential Buildings (CARB), a Building America research team led by Steven Winter Associates, has done extensive research on the feasibility of insulating ducts that are located in the attic and has developed an insulating method it terms buried and encapsulated ducts (BEDs). Rather than hanging the ducts up in the rafter using strapping, the ducts are laid on the attic floor and buried in several inches of loose-fill insulation. CARB research has shown that in dry climates this technique will provide excellent results without condensation concerns. In humid and mixed climates, the ducts should be encapsulated in closed-cell polyurethane spray foam insulation, before being covered with loose-fill insulation. The spray foam also provides the added benefit of additional air sealing, although the ducts should be sealed before covering with loose-fill insulation.

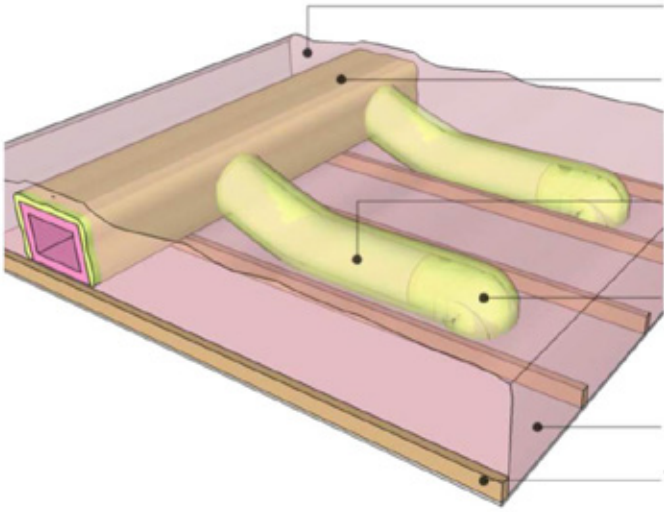
BEDs offer all of the benefits of locating ducts in conditioned space without some of the drawbacks. In comparison to insulating the entire attic by spray foaming along the underside of the roof deck, they are much cheaper to install because much less spray foam is needed to cover only the ducts. A standard application costs about $600 to $1,000 and this cost increase might be offset by allowing for a smaller capacity HVAC system. BEDs are a good option for homes with low ceiling heights where it is not possible to drop the ceiling to install the ducts within the conditioned space. The installation is not disruptive to the construction sequence: the spray foam can be installed either before or after the installation of the ceiling gypsum board.

(Top left) Building America research shows encapsulating ducts in spray foam and burying them in the attic insulation can give builders nearly all the benefits of locating the ducts in conditioned space without the expense of a fully insulated attic.

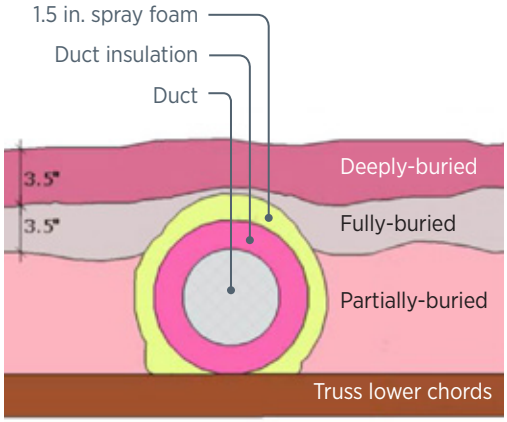
As a result of Building America research, BEDs have been incorporated into several energy conservation codes and standards. BEDs are allowed in the 2009 International Residential Code and are permitted in the U.S. DOE Challenge Home as an alternative to the requirement for ducts inside the conditioned space. CARB's work resulted in changes to the California energy code (Title 24) with the adoption of buried ducts as an alternate compliance path.

Lessons Learned

- Buried, unencapsulated ducts cannot be installed in moist or marine climates because there is a risk of condensation on the surface of the ductwork; however, CARB research showed encapsulating ductwork with an adequate amount of closed-cell spray foam prior to covering with blown insulation will adequately prevent condensation.
- Spray foams can be installed in attics as long as an appropriate ignition barrier is used. Loose-fill fiberglass qualifies as an ignition barrier if it is installed to cover the top of the duct by at least 1.5 inches over the top of the spray foam.
- Spray foams may be left exposed in attics as long as they are specifically rated for exposed applications.



BEDs 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), BEDs can also be used as a high-performance duct insulation strategy in all climates.



Building America research shows encapsulating the ducts in spray foam before covering with loose-fill insulation provides adequate protection against condensation making this low-cost, high-performance method appropriate for every climate zone.

REFERENCES

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Energy Efficiency & Renewable Energy

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PNNL-SA-98654 September 2013

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