Building America Case Study
Whole-House Solutions for New Homes

Inverted AtticBulkhead for HVAC Ductwork
Roseville, California

PROJECT INFORMATION
Project Name: Long-Term Monitoring of Occupied Test House
Location: Roseville, CA
Partners: K. Hovnanian® Homes®, www.khov.com
IBACOS www.ibacos.com
Building Component: Envelope, structural, HVAC ducts
Construction: New
Application: New; single and/or multifamily
Year Tested: 2012
Applicable Climate Zone(s): Hot-dry climate

PERFORMANCE DATA
HERS Index: 52
Projected Energy Savings:
11 million Btu/year heating and cooling savings
Projected Energy Cost Savings: $116/year

Modifying the truss system of a new home to accommodate ductwork within an inverted insulated bulkhead along the attic floor can save energy by placing heating, ventilating, and air-conditioning (HVAC) ductwork within the home’s thermal boundary. U.S. Department of Energy Building America team IBACOS monitored the performance of a new 2,253-ft² single-story slab-on-grade ranch house with three bedrooms and two full bathrooms constructed in Roseville, California, for one year as an occupied test home. The air handling unit for this low-load house in a hot-dry climate was relocated from the unconditioned attic to a central location inside the conditioned space of the house.

The reverse attic bulkhead is placed over the HVAC equipment closet with the approximate area of the cavity created by a new truss design used to create an unobstructed space to accommodate the ductwork. The following should be verified to ensure that the compact duct distribution system is properly designed and implemented:

- Verify truss modifications meet engineering requirements for load bearing.
- Verify the bulkhead is adequately sized to accommodate the ductwork.
- Verify all penetrations and intersections in the bulkhead are carefully sealed.
DESCRIPTION

To effectively implement the reverse bulkhead approach, one important factor is that the redesigned truss must not affect the bearing location at the footing level.

The original design, as shown below in the upper image, can be modified to the proposed design, as shown in the lower image.

Original design

Modified design

The modified design can provide a centrally located chase along the floor of the attic.

In this example, to provide a central bearing location that was consistent with the existing structural design for the home, a framing member was dropped from the truss web to bear on the interior load-bearing partition wall.

Long-term monitoring shows that temperatures inside the bulkhead, in both the cooling and heating seasons, run close to the thermostat set point and are isolated from the vented attic extremes. The differences, particularly during the heating season, point to the continued need for insulated ductwork for this scenario.

Lessons Learned

- Inside the thermal boundary is different than inside conditioned space. Insulated ducts are still necessary.
- Involving the truss manufacturer early in the design can help resolve any structural bearing issues.

For more information, see the Building America reports, *Short-Term Monitoring Results for Advanced New Construction Test House- Roseville, California, Strategy Guideline: Compact Air Distribution Systems*, and *Measure Guideline: Implementing a Plenum Truss for a Compact Air Distribution System*, at [www.buildingamerica.gov](http://www.buildingamerica.gov)

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