

Building America Case Study Technology Solutions for New & Existing Homes

Measure: Sealed Air-Return Plenum Retrofit

Melbourne, Florida

PROJECT INFORMATION

Project Name: Habitat for Humanity
of Brevard County, Inc.

Location: Melbourne, FL

Partners: Habitat for Humanity

Building America Partner:
Pacific Northwest National Laboratory

Building Component: HVAC

Application: Single-Family Retrofit

Year Tested: 2011

Climate Zone(s): Hot Humid

PERFORMANCE DATA

**Cost of Energy-Efficiency Measure
(including labor):**

Whole House Retrofit: \$7,867

Air Distribution System

Improvements: \$782

Projected Energy Savings:

Whole House Retrofit: 35%

Air Distrib. System Improvements: 4%

Projected Energy Cost Savings:

\$60 per month or \$731 per year

Leaks in a home's heating, cooling, and ventilation (HVAC) system can reduce occupant comfort and force the equipment to consume more energy to deliver the same amount of conditioning. While leaks are frequently found in the unsealed joints of ducting, poorly designed air-return plenums and leaky air handlers can also hinder HVAC equipment performance.

This project focused on a home in which the air handler closet served as the home's air-return plenum, housing the leaky air handler mounted on a stand. The closet was closed off behind a louvered door that restricted air flow to the unit, causing depressurization inside the home. While common in older Florida homes, this configuration can cause uncontrolled air flows, dust build up, and occupant discomfort. In high radon areas, depressurization can lead to increased indoor radon levels.

The Florida Solar Energy Center, as part of the Pacific Northwest National Laboratory Building America research team, partnered with Habitat for Humanity of Brevard County, Inc. to resolve these issues. The team replaced the existing air handling unit with a new unit that was mounted on top of a framed, sealed air-return plenum located under the air handler. A wall-mounted filter-back return grille was also installed to reduce dust accumulation and improve indoor air quality. In addition to sealing the air handler and closet, the team performed additional duct sealing, which reduced leakage from the air distribution system to the outdoors from an initial 206 cubic feet per minute at 25 pascals of depressurization (cfm25) to 52 cfm25.



Adding an outdoor air intake vent to the air handler closet delivers fresh air to the conditioned space and improves indoor air quality.



(left) The existing air handler was extremely leaky and mounted on a stand in the air handler closet. The closet was separated from the conditioned space by louvered doors, which restricted return air flow.

(right) The new air handler was installed on top of a framed, sealed base that acted as the air-return plenum. A filter and grille were installed to prevent dust accumulation and improve indoor air quality.

Sealing and reconfiguring the return air pathway presented an excellent opportunity to install ventilation. In a hot, humid climate, a run-time ventilation duct can be incorporated directly into the air handler return to supply outdoor air while the air handler is operating. This can further improve indoor air quality. It is important to ensure that the ventilation inlets are away from outdoor contaminant sources and are unobstructed. Ideally, outdoor ventilation inlets will have a dedicated filter.

Lessons Learned

- The practice of installing air handlers on a stand, using the entire closet as a return with no filter, is common in Florida homes. However, this configuration can lead to dust accumulation and excessively leaky air distribution systems.
- Constructing a sealed air-return plenum decreased duct leakage to the outdoors from 206 cfm₂₅ to 52 cfm₂₅, almost a 75% decrease. Adding a filter will improve indoor air quality for the occupants. Plenums should be lined with duct board and must be completely sealed with mesh and mastic at seams and edges with particular attention at the grille opening.
- It can be difficult to install a sealed, platform return and new heat pump if the new air handler is larger than the existing air handler closet. Also, clear communication with the trades is needed to ensure effective installation of the air return and ventilation duct detail.
- Sealing this home's leaky duct system and adding a dedicated, sealed air return is expected to save \$82 per year in energy costs while dramatically improving indoor air quality and comfort. With an installation cost of \$782, this measure will pay back after 9.5 years.

Looking Ahead

Upgrading and improving existing duct work and air-return plenums represents an opportunity for contractors to both save energy and improve occupant comfort. Correctly sealed air-return plenums with filters can improve indoor air quality and allow greater control over air flow in the home. Air handlers in conditioned space present an excellent opportunity to further improve indoor air quality and increase energy efficiency by locating ducts in conditioned space.

For more Information, see the Building America report at www.buildingamerica.gov

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

www.buildingamerica.gov

PNNL-SA-89691 August 2012

The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.