

## PHRC Report: #40: Evaluation of Duct Sealing Effectiveness

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### BACKGROUND:

Inefficiencies in residential HVAC duct systems have been identified as a major source of energy loss in homes by several researchers. They have found that approximately 30-40% of the energy delivered to duct systems passing through unconditioned space is lost along the way through air leakage and conduction losses. About half of these losses are due to leakage, and leakage retrofits can significantly reduce these energy losses. Computer analysis has also shown that free convective flow can cause substantial losses through duct leaks even when the HVAC system is not operating.

Jump has found that 64% of the leaks in a heat pump ducting system could be sealed at an average cost of \$14 per m<sup>2</sup> of duct surface, or \$514 per house. The energy savings that he achieved are not relevant to the present study because the ducts were insulated as well as being sealed.

### OBJECTIVES:

This project is a field study of the cost effectiveness of the sealing of the ducting of air-source heat pump home heating system in Pennsylvania. This study includes:

- Performing a diagnostic protocol on the distribution systems of seven houses with heat pumps;
- Performing a month-long monitoring of the energy use and system performance in the houses;
- Carrying out a project to seal the ducts in the houses;
- Re-testing the houses with the diagnostic protocol;
- Performing the post-retrofit month-long monitoring of energy use and system performance in the ten houses; and
- Using computer simulation to correct for weather, calculate the effects of the duct sealing project.

This project was started in the fall of 1994. The required monitoring equipment was installed in the seven houses, and about a month of energy performance data has been collected. Two of the houses eventually dropped out of the study. In the remaining five houses, the ducts were sealed and energy use was monitored for another month long period. The computer simulation was carried out and a final report has been submitted.

#### **CONCLUSIONS:**

Although the ducts in this study were found to be very leaky, sealing of all visible leaks was not found to result in a significant energy savings in four of the five houses. We believe this to be because stack effects cause heat lost to unconditioned basements to actually be recovered to the houses. One house in this study did benefit from the retrofit. This house had a significant portion of its sealed duct leakage in the attic, indicating that in this climate leakage to attics may cause a greater energy loss than leakage to basements. However, another house with an attic did not benefit from the duct sealing project. The results indicate that although duct retrofits might save energy in some houses, they are not likely to result in worthwhile savings in many central Pennsylvania houses with most ductwork located in heated spaces or in basements. Due to the small number of houses tested in this study, more study may be needed to identify types of houses that would benefit from duct sealing in this climate.