Pressure Regain Strategies for Existing Air Distribution Systems

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Problem Statement

Thermal enclosure upgrades can reduce peak loads by 50%. If the furnace is right-sized for this new peak load and the ducts are not modified or replaced, the resulting airflows at the supply registers will be significantly reduced.

- –Will the outlets meet industry standards for performance?
- – Should they be replaced to achieve good room air mixing?
- – Should the end of the duct be modified to improve airflow characteristics?

Expected Results

We expect to find a cost-effective solution to gaining proper airflow to a room without completely replacing the existing ductwork.

Research Question #1

At what level of load reduction (airflow reduction) will the existing delivery mechanism no longer sufficiently provide comfort?

- Perform mathematical analysis based on existing standards to determine the percentage reduction in airflow whereby design airflow velocity may be insufficient to provide adequate throw to facilitate room air mixing.
- ACCA and ASHRAE standards

Research Question #2

What are the cost-effective designs (up to three) for a pressure regain register strategy?

- Material costing
- Time/motion study

Possibilities:

- Sealing off part of the existing outlet
- Insertion of smaller ring to duct with existing outlet
- Smaller register with new boot

Research Question #3

- Are the proposed cost-effective designs for a pressure regain strategy able to meet ACCA and ASHRAE standards for airflow velocity and noise?
  - Bench tests
  - Field tests
  - CFD
  - TRANSYS model

Critical Points

- Cost
- Ease of installation
- Distribution velocity
- Flow volume
- Noise at face

Background and Assumptions

- Need to get ducts into conditioned space
- Flex replacement is cost effective
- Metal ducts inside conditioned space
- Cold climate
- Floor outlets
- Basement

References

- House characterization study (IBACOS)
- Industry “rules of thumb”
- Retrofitted house data from IBACOS projects
- Residential energy conservation study
- FSEC “over sizing to run at low speeds” report
- Ian Walker LBNL blocked vents paper 2003
- ASHRAE Fundamentals 2009, Chapters 20 and 21
- ACCA Manual D
- ACCA Manual S
- ACCA Manual T

Status

- Test plan submitted
- Early background research begun
- Go/No Go based on turbulence, noise, and downstream effects per ACCA and ASHRAE standards (August 2013)
- Assemble documented conclusions into a technical report (August 2013 – December 2013)
- If reasonable strategies are found, plan for 2014 activity to include laboratory testing at IBACOS of strategies, and identify partners to field test strategies in occupied test houses.

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