

Air Flow Visualization System Using IR Thermography

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Background

Building science thermography requires the knowledge and understanding of where and how heat transfers and air flows throughout a building envelop. Infrared thermography is one of the most valuable diagnostic tools for building energy efficiency, and for air leakage, handler (i.e., fans, blowers) and distribution (i.e., duct/plenums, registers and diffusers) systems. Of particular interest is the ability to “visualize” convective energy loss due to air leakage from the building envelop or duct system. Of course, all thermographers recognize that air is transparent in the infrared spectrum. This statement is valid for traditional cameras, both long or medium wave regions, and from a rather short distance of observation. Transparency means no absorption, which translates into no emission. Thus, in the end, air cannot be imaged directly.

Purpose

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) provide annual support for senior projects through its Senior Undergraduate Project (SUP) Grant Program. The Mechanical Engineering Program in the Department of Engineering at Western Kentucky University received a SUP Grant for academic year 2012-2013. The purpose of this project grant is to design, build and test (DBT) a simple and easy-to-implement indirect visualization system. This will aid the energy auditor in visualizing air flows with IR thermography when a building surface is not readily available to image this convective heat transfer phenomena. Excessive air leakage in building envelops or from duct systems is known to be a major contributor to the energy consumed in conditioned buildings. With this tool, an estimate of energy losses and mitigation methods can be determined.

Design/Method

A calibrated Air Moving Device (AMD) such as a blower door/duct blaster is used to achieve the desired air flow rate for the system. The Air Flow Visualization System (AFVS) also conditions the air to a desired temperature sufficiently high enough above or below the room air temperature to produce a discernible thermal image. An infrared camera is used to capture these visual images of the conditioned air “spilling” perpendicular to an opaque, low conductive and high emissivity screen. Other quantifying data such as air flow rate, pressures and temperatures are recorded and correlated to this captured image.

Results

At the time of abstract submission, the AFVS system has not been completed. Therefore, further details on this DBT project will be presented at the student conference poster session.

Conclusions

The goal of this project grant is to design an air flow visualization system using infrared thermography. Discernible thermal images and patterns produced by the AFVS can give a field energy auditor insight into leakage or flow rates, which can then be used to estimate energy loss and implement mitigation methods.