

Cold Air Intake for a Residential Air Conditioner

John A. Casebolt

Jai N. Dahiya

Physics and Engineering Physics Department

Southeast Missouri State University

Cape Girardeau, Mo 63701

jacasebolt1s@semo.edu; jndahiya@semo.edu

(573) 264-3929 ; (573) 986-6036

Title: Cold Air Intake for a Residential Air Conditioner

Objectives:

1. To determine the feasibility of a residential economizer in the Southeast Missouri area. By data analysis of ten years of temperature readings for Cape Girardeau, Mo to determine the number of hours in a given target range. This process allows the students to retrieve data and compile it using an excel spread sheet. The data is available on the National Climate Data Center (NCDC) web site and is free to web domains ending in .edu or .gov.
2. To design a residential economizer. This will allow students to look for ways to adapt a similar system in their homes. While it is not realistic to believe that these systems will be implemented, the exercise will give students the opportunity to explore energy conservation on a personal level.
3. To design and build a simple dual system control switch needed to switch between the economizer and the standard air conditioning systems. This is a simple circuit that requires few components and is adaptable to applications other than temperature control. The Students will learn basic knowledge of circuits and current flow. The details of circuit analysis can be adjusted to facilitate groups from high school physics to undergraduate engineering students.

Activity:

The presentation will consist of a power point presentation along with a demonstration of the control switch. The cold air intake system is modeled on the economizers used in large commercial air conditioning systems, where ambient heat from equipment and large numbers of people add to the indoor air temperature. The buildup of heat in residential home is due largely to radiant heat from the sun during the day. The cold air intake system includes a programmable thermostat that allows the home owner to set the day time temperature to a higher setting so that the air conditioner isn't working during the day while everyone is at work or school. Many times in the late spring and early fall; the outdoor temperature will be cooler than the indoor temperature. The economizer uses motorized air dampers and an additional air duct connecting the cold air return to the outside. The dual system control switch uses two temperature sensors (one indoor and one outdoor) to compare the indoor and outdoor air temperatures. If the outdoor air temperature is less than the indoor air temperature, the controller opens the outdoor air damper and turns on an exhaust fan to remove the warm air while bringing in cooler air from outside and filtering the dust and allergens through the allergen filter used by the cold air return. When the two temperatures are the same or the indoor temperature is less than the outdoor temperature, the system closes and the compressor turns on and works as a standard air conditioner.

The collection of data will be covered along with an explanation of the spread sheet. Depending on the class, students may be asked to create a spread sheet or use one provided by the instructor. The design of the economizer system will be reviewed in the power point presentation. The circuit design will be covered with three options available to allow the

project to be tailored to the particular class. The display unit will be available for further inspection.

Grade level: High school to undergraduate

Time required: 1 hour

Equipment and supplies:

Projector and computer for the power point, table near a 110V power outlet for the display unit.