Checking Economizer Operation

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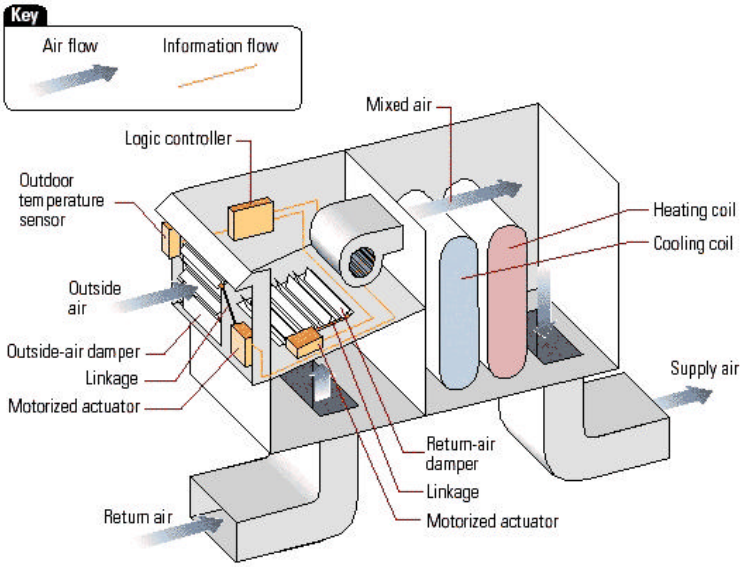
Nearly 50% of new economizer installations have one or more problems that reduce their effectiveness and increase operating costs over the life of the system. The purpose of this factsheet is to give you some tools you can use to check for proper operation of new economizers to insure they operate as intended

Let's start with a brief review of how economizers work. Sensible economizers are controlled by the temperature of the air and provide sensors to measure the outside air temperature, return air temperature and the mixed air temperature. Enthalpy economizers operate similarly, except they respond to enthalpy (i.e. the total amount of heat in the air) instead of temperature.



The working components of an economizer consist of an outside air damper, a return air damper, an electronic controller, sensors and a sheet metal frame. Usually there also is a relief damper, relief fan or a remote air damper that exhausts the building air during economizer operation. Better quality economizers have two outside air dampers – a smaller one sized to admit the amount of outside air required during occupancy (roughly 20 – 30% of the total system CFM) and a larger damper used in economizer operation and capable of admitting the full CFM of the fan.

The economizer modulates exhaust air, return air and outside air dampers to maintain the mixed air temperature at its setpoint (around 60ºF.) The action of the outside air damper and relief damper, if there is one, should always be opposite that of the return air damper. When the outside air is cool enough to cool the building (about 60ºF or less) and there is a call for cooling, the

economizer is energized and modulates the outside air damper (and any relief damper) open and the return air damper closed. If the system uses a relief fan, it should start. As the outside temperature increases above what is required to cool the building, the outside air damper and relief damper modulate closed and the return damper modulates open.

In enthalpy economizers, the enthalpy of the return air is compared to the enthalpy of the outside air. (note: enthalpy is the total heat content of the air). When the enthalpy of the outside air is lower than that of the return air, the economizer cycle is actuated just as the sensible economizer described above is when the outdoor temperature is cool. The big advantage of the enthalpy economizer is that it takes into account the humidity in the air when deciding if outside air is adequate to cool the building. This can increase economizer savings an additional 10-15% when compared to a sensible economizer.

Economizer Controllers

Modern economizer controllers combine all logic functions, control algorithms and switching into a single package. Temperature sensors, damper actuators, power supply and other miscellaneous wires are connected to the controller. Controllers are usually mounted on or in the equipment they control. Most have an outside air sensor mounted under the rain-hood and if you trace its wires back, they will take you to the economizer controller. Please note that about 70% of these controllers use the Honeywell C7650 sensors which are outdated and have caused control problems. Honeywell recommends replacing these sensors with the C7660 sensor.

The instructions that follow are for the most common economizer controller – the Honeywell W7212 – which probably accounts for over half of all economizers currently in production. Most other controllers are similar enough that you should be able to check them using the following instructions. If the unit you are inspecting is very different and you can't figure out how to check it out, look around the equipment for the economizer controller manual – or ask the owner's representative or the contractor. If there is no manual available on site, you can usually download one from the manufacturer's website.

If the economizer uses Honeywell C7650 sensors, they should be replaced with the Honeywell V7660

Check-out

When checking-out the equipment, try to make arrangements for the control contractor (or whoever installed the controls) to meet you at the job. He or she can explain how the system works and help with the testing.

First, locate the outside air damper on the HVAC unit. It should be visible from the outside under the economizer rain-hood. When you spot it, shut the power off to the unit at the HVAC disconnect and watch the outside air damper. It should close slowly and you may be able to hear the actuator motor. If the outside air damper does not close, there

is a problem with the system that will need to be repaired before proceeding. If the damper did close, turn the system back on by closing the HVAC disconnect.

In order for the economizer to function, the HVAC system needs to be on and in the first stage of cooling. This is most easily accomplished by connecting a jumper wire at the terminal strip. **This should be done by the installer in accordance with the manufacturer's recommendations**. If the outdoor temperature is below 60ºF, the unit's outside air damper should slowly modulate open. If it doesn't, try cooling the outside air sensor with some ice in a plastic bag or by spraying it with compressed air. If the unit refuses to modulate open, it's time to have a discussion with the installer and have them work through the troubleshooting procedures in the controller's instruction manual.

Next check the operation of the minimum outside air (MOA) adjustment. This is the potentiometer noted as "min. pos." on the module. First, note the position of the MOA potentiometer so you can return it to this position when you're done. Next, adjust the position of the potentiometer and watch the outside air damper. You should see it open and close as you adjust the potentiometer. If you don't, again, you should have the installer troubleshoot and correct the problem.

The information contained in this article may not apply to all available products. Check with the HVAC installer or manufacturer for specific economizer testing protocols. If you would like more information on economizers and the various problems with sensors and controllers discovered by the New Buildings Institute, visit thir webpage at:
http://www.newbuildings.org/downloads/NWPCC-BenchTestReport_June2008.pdf