

Assessing Economizer Performance

Air-side economizers are control devices that open and close dampers to bring in outside air for cooling and ventilation. They save energy by using outside air for cooling when the outdoor air is cooler than the return air. Unfortunately, improper operation of economizers is quite common and often goes unnoticed, resulting in increased energy use. This application note describes a relatively simple procedure used to assess an economizer's performance.

Economizers are required by Title 24, Section 144(e) 1 for cooling fans with a capacity over 2500 CFM and a cooling capacity over 75,000 Btu/hr.

Equipment Needed

- 4 Hobo XT (or Stowaway XT) dataloggers
- 1 HOBO software and communication cable

NOTE:

When measuring air temperatures, **sensor tips must be shielded** from sources of radiation such as the sun or cooling coils. Is a sensor able to "see" the source of radiation? If it can, it should be shielded with a reflective material such as aluminum foil. The foil should not be in contact with the sensor, nor constrict air flow around it.

Procedure

- Step 1:** Launch the Hobo XT dataloggers. (See Onset Software application note for instructions.) In most cases, we recommend configuring the loggers to operate for a period of two weeks. Make sure that the *overwrite data* box is selected (in the Hobo software) to insure that you are collecting the most recent data.

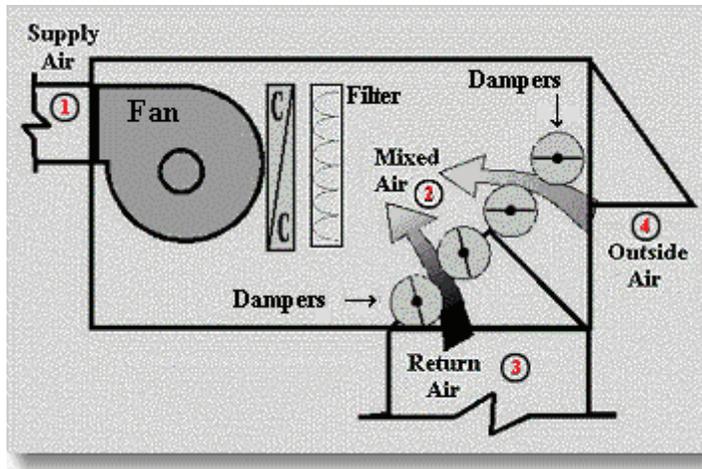


Figure 1 Diagram of a rooftop AC unit

Step 2: Place the Hobo XT thermistor tips in different air chambers (Figure 1). The loggers should be fastened securely with duct tape as the air at high speeds within the unit can lift the loggers away. Insure that the thermistor is suspended in the air chamber and not touching heating/cooling coil or other surfaces. If you are conducting long-term studies, consider securing the logger in such a way that provides easy access to the cable port.

Supply Air Temperature [SAT] (1). Place a HOBO downstream of the cooling coil.

Mixed Air Temperature [MAT] (2). Place a logger in the mixed air stream. It is important that the sensor is in a well-mixed location as far downstream from the mixing dampers as possible without being too close to the cooling coil.

Return Air Temperature [RAT] (3). Place a HOBO in the return air upstream of the mixed air dampers.

Outside Air Temperature [OAT] (4). Place a logger in a protected location near the outside air grill. Avoid a location where the sensor will receive direct sun. If you cannot find an ideal location, shield the sensor with aluminum foil to block direct sun allowing air to flow around the sensor while making no contact with it.

Step 3: After the data collection period has expired, retrieve the loggers from the field and download the data.

Step 4: Transfer data to a spreadsheet with the time for each sensor coincident. Graph all four data series on one chart to assess performance. The Energy Center developed a spreadsheet automating the graphing processes. Click here to download a copy of this spreadsheet, [Econ.exe](#) [self-extracting zip file 564k]

Looking at the Data

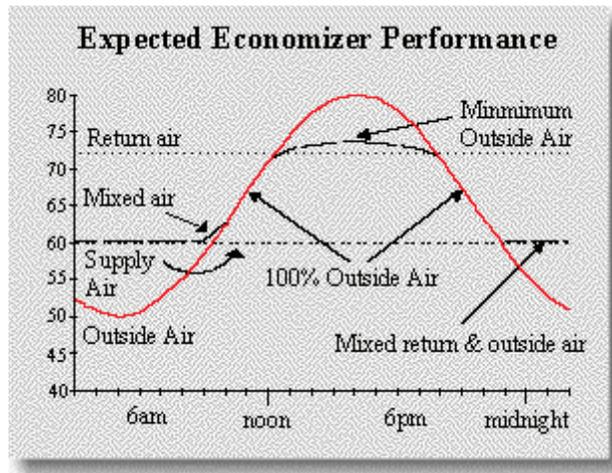


Figure 2: Graph of ideal economizer operation

The mixed air temperature and the outside air temperature should track closely when the outside air temperature is above the minimum supply air setpoint. This condition should persist until either; a) the outside air temperature exceeds the return air temperature, or b) the outside air temperature is below the minimum supply air temperature setpoint. Under these conditions the percentage of outside air brought in is reduced and the mixed air temperature and supply air temperature drift apart. For ventilation purposes, the outside air is never reduced to 0%.

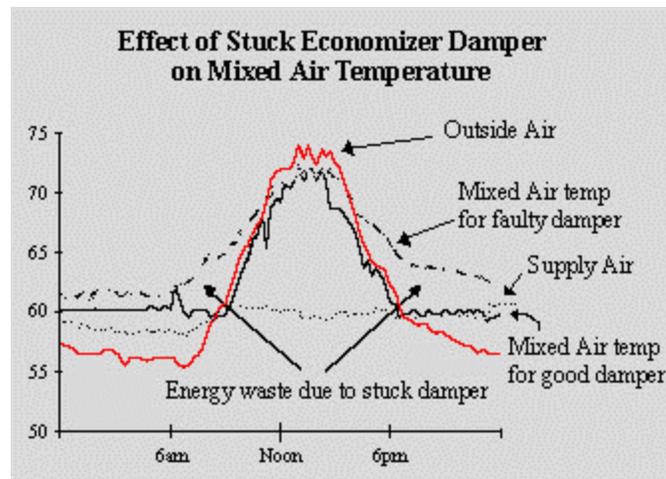


Figure 3: Typical data from an economizer with a stuck damper

Compare fig. 2 with fig. 3. Fig 3 shows that the mixed air temperature is not tracking outside air temperature even though the outside air is cooler than the return air. The most likely scenario is that the outside air damper is stuck in a closed or nearly closed position. If the damper was stuck open we would expect to see the mixed air temperature track outside air even when the outside air temperature is hotter than the return air or cooler than the supply air setpoint.