Tech Tip # 115

Economizer for Indoor Pools

Keywords: Economizer; Indoor Pool; ASHRAE 90.1

Introduction

ASHRAE 90.1 Energy Standard for buildings recognizes the importance of economizers in most climatic zones. This bulletin will provide an analysis of using an economizer sequence for an indoor pool room.

Economizer Basics

Pool room design conditions are significantly different than most commercial building applications. Most notably the space is maintained at a higher temperature and higher humidity level than traditional buildings. Additionally, the high latent load of the pool requires dehumidification. Outdoor air may be able to offset this load, but the simultaneous impact of the heating or cooling load of the outdoor air must be considered. This is is significant contrast to the standard commercial air conditioning load where internal latent gains are not a significant load during cooler outdoor temperatures.

Desert Aire's economizer sequence will assist the dehumidifier in cooling or dehumidifying when outside conditions are within specific zones where increased outdoor air can provide an offset to indoor loads (see Figure 1). The control sequence uses the design temperature and humidity set points in determining the upper end of the economizer zone as well as a manually entered low temperature value for the lower zone. The Desert Aire sequence is substantially similar to the differential enthalpy with fixed dry bulb control type according to the typical efficiency standard, however, the sequence has been optimized to work with the higher temperatures and the interior dehumidification needs for a pool room.

The following description summarizes the zones formed with these set points:

Standard Dehumidifier Operation

If the outdoor air condition does not offset the cooling or dehumidification load, the unit will introduce only the amount of outdoor air programmed based on the current mode of occupancy. Compressors, valves, and heaters in the unit will work to provide heating space temperature and humidity control.

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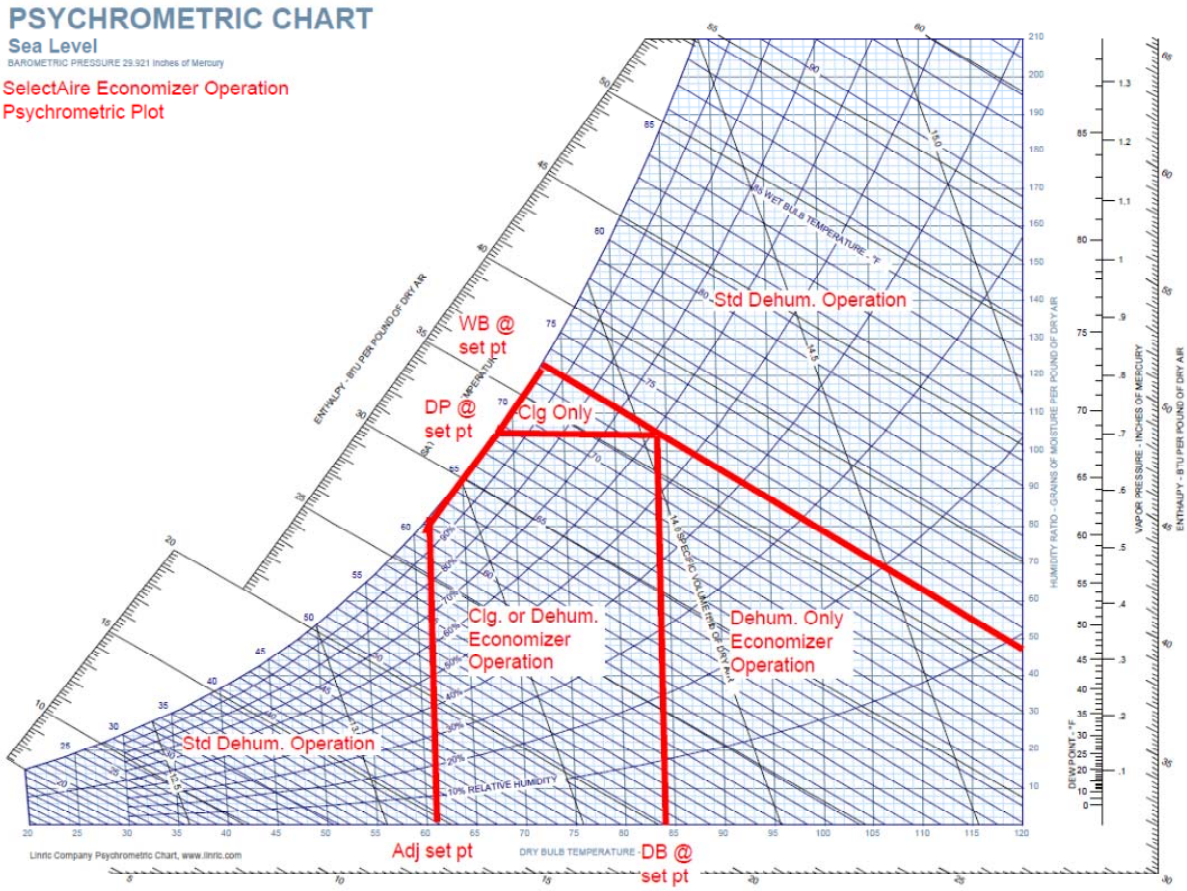

Figure 1- Economizer Zones

<u>Economizer operation</u>

The dehumidifier will vary the volume of outside air to maintain the space at its desired set point. If the outside air cannot maintain the space conditions, the compressors will energize as second and third stage dehumidification or cooling. There are (3) Economizer operating conditions provided by the Desert Aire sequence.

- Dehumidification Only Zone
  If the outside air temperature is warmer than the space set point and outdoor enthalpy is lower than the zone the unit will introduce additional outdoor air if the zone condition calls for only dehumidification. This ensures the additional outside air is appropriately used for dehumidification without adding a greater cooling load.

- Cooling Only Zone
  If the outside air temperature is cooler than the space set point and the outdoor air enthalpy is lower than the zone, the unit will function in the economizer mode on a call for only zone cooling. This ensures the additional outside air is appropriately used for cooling without adding a greater dehumidification load.

- Cooling or Dehumidification Zone
  When the air is cool and dry, but not too cold (above the Low Temperature Economizer lock-out temperature), then the economizer function will be active on a call for space cooling or dehumidification.

Guide specification for the economizer sequence:

An Outdoor Air Economizer Mode shall be provided. Hardware shall include outdoor air temperature and humidity sensor. Sequence shall be programmed specifically for a pool environment and will include both dry bulb and differential enthalpy control. Fixed dry bulb temperature only or fixed enthalpy only control types shall not be acceptable. Provision to be provided for lockout of outdoor air temperature where ambient temperature would require high levels of energy for heating. This lockout shall be field adjustable.

Conclusion and Energy Savings

This Desert Aire sequence has been developed for those applications that have a building code requirement to include an "Economizer Sequence" in a pool dehumidification system. However, it has been the experience of Desert Aire that forcing a dehumidifier to include an economizer may actually cause the energy consumption for an indoor pool to actually increase, not decrease.

The main reason is for this increased energy use is the very warm indoor temperature that must be maintained in an indoor pool. This keeps the space in the heating mode for a longer time period. The outdoor moisture content is lower so the outside air can help dehumidify the space but the outdoor air must also be heated. This extra heating cost may exceed the costs of operating the compressors for many locations. Additionally, the increased energy use of the fan system to introduce outdoor air and associated exhaust air offsets the benefits of compressor use reduction.

As part of its energy saving design, the SelectAire energy recovery technique recovers energy contained in the exhaust air and returns it back to the facility. An energy analysis can confirm the operating costs in your facility for systems with and without an economizer.