APC

APPLICATION NOTE #62

Dedicated Dehumidification Cycle for CRAC

Abstract

This application note discusses how the NetworkAIR FM dedicated dehumidification works and saves on the reheat and humidification requirement.

Cooling modes

Computer room air conditioners have four modes of operation. These modes are:

- Cooling – The process of removing heat from the air.
- Dehumidification – Latent cooling.
- Heating (reheating) – Adding heat to the air.
- Humidifying – Adding moisture to the air.

Of these four modes, cooling has more priority in the control scheme than the other three. Cooling can be used in conjunction with humidifying since some latent cooling will occur in that mode.

Cooling / Dehumidifying

The return air sensors report temperature and humidity readings to the microprocessor. These readings are compared with the set points of the unit to determine the required mode of operation. Should the return air temperature require cooling and dehumidifying at the same time, cooling mode would be started (or maintained depending on last mode and minimum cycle times). This is done as a priority over dehumidification mode, since the cooling mode will have some latent capacity and dehumidify at the same time.

Should the temperature be satisfied and the relative humidity still remains above tolerance, the system would start the dehumidification mode. During this mode, the sensible effect on the air temperature must be neutralized to prevent over cooling of the room. For this reason, the heating mode would be used as necessary to reheat the air before distribution.

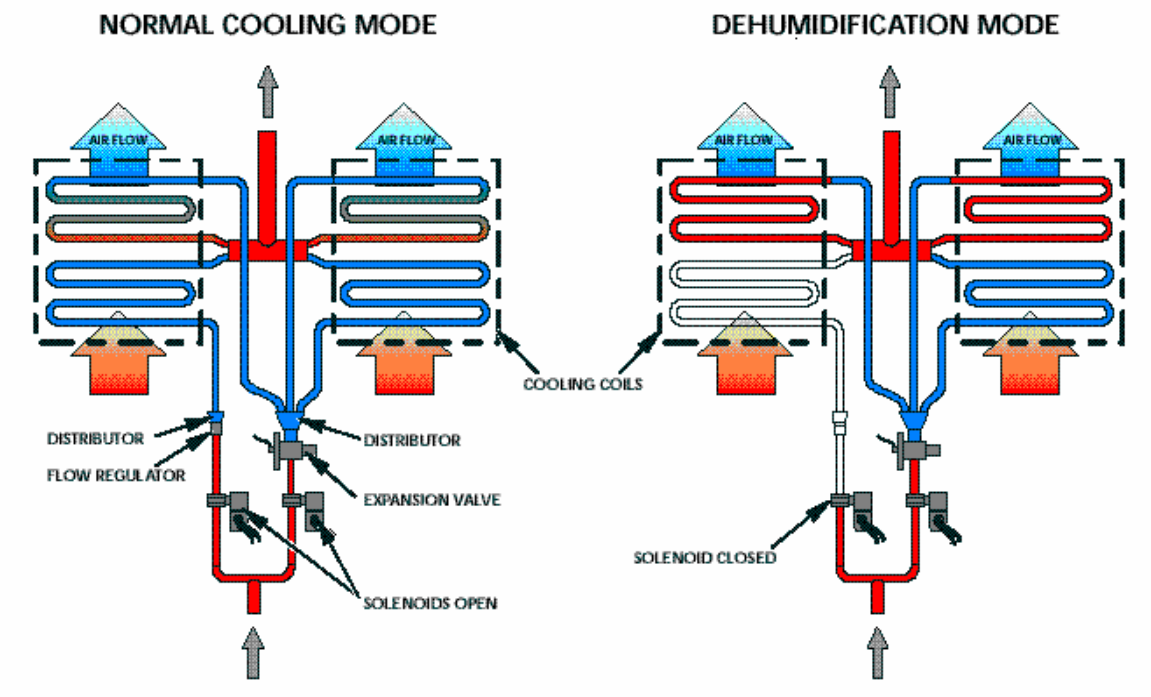
Over cooling

In order to satisfy the latent requirement during dehumidification mode, most computer room air conditioners will operate in cooling mode. This process requires that large amounts of reheat is installed that can handle the net sensible effect of cooling mode until the relative humidity set point is satisfied or cooling mode is called for from a return of heat load.

Dedicated Dehumidification

The NetworkAIR FM utilizes a different type of dehumidification scheme. Since the only requirement is to have some latent capacity without cooling the air during this mode, the sensible capacity is less than cooling mode while increasing the latent capacity.

This is accomplished by circuiting the coil into quarter sections. Three quarters are fed from one distributor and the other quarter is fed from another. Each distributor is fed from an upstream solenoid. During two compressor cooling, both solenoids are open and the entire coil is used.



When the cooling set point has been satisfied and a demand for dehumidification is initiated, the dehumidification solenoid is de-energized, closing off one quarter of the coil, and one or both compressors are started. With a greater coil surface area of one compressor and three quarters of the coil, the sensible heat ratio of the system is higher than in cooling mode, while still

maintaining some latent capacity. However, given the demand for dehumidification, the higher moisture content of the entering air, results in more pounds per hour latent capacity than during cooling mode in most cases.

FM35, Air Cooled					
Cooling Mode		**Dehum (1 Compressor)**		**Dehum (2 Compressor)**	
72F DB, 50% R.H.		72F DB, 60% R.H.		72F DB, 60% R.H.	
Total	109,000 (31.9)	Total	55,000 (16.0)	Total	104,000 (30.3)
Sensible	105,000 (31.0)	Sensible	50,000 (14.6)	Sensible	73,000 (21.3)
Lbs/Hr.	**3.72**	Lbs/Hr.	**4.65**	Lbs/Hr.	**28.86**

This can also be demonstrated on a psychrometric chart by plotting the entering air conditions relative to the dew point of the coil during cooling and dehumidification modes.

EAT Dehum	Entering air temperature in dehumidification mode (72/60%)
EAT Cooling	Entering air temperature in cooling mode (72/50%)
D1	Dehumidification mode with one compressor running and ¾ coil
D2	Dehumidification mode with two compressors running and ¾ coil
C2	Cooling mode, two compressors and full coil