Q-PUMP PROVIDES HIGHEST COP

Q-PUMP™- 100% OUTDOOR AIR SYSTEM

Desert Aire's Q-Pump™ system (protected by patent #6,666,040 and an additional patent applied) uses a four-element refrigeration system to overcome the typical problems of a two-element reverse cycle system, including:

1.) **Reduced efficiency and performance.**
2.) **High cost of oversized refrigeration valves.**
3.) **Potential for liquid slugging and need for accumulators.**
4.) **Refrigerant suddenly flashing into vapor, violently expanding and damaging pipes.**

Desert Aire's Q-Pump™ dehumidifier uses a unique method of heating 100% outdoor winter air without the need for a separate auxiliary heat source such as a gas furnace. The system utilizes an Electronic Expansion Valve (EXV) to insure the best performance and operation at low outside air temperatures while reducing the set-up time. At typical airflows for DOAS, our basic system is effective down to 0°F winter design temperature. With an optional enthalpy wheel, the system is effective down to minus10°F.

The key difference between Desert Aire's Q-Pump™ option and prior solutions is the use of two independent water condensers. One acts as the true condenser for the balance of the total heat of rejection (THR) of the system and the other is the evaporator in the reverse cycle heating mode.

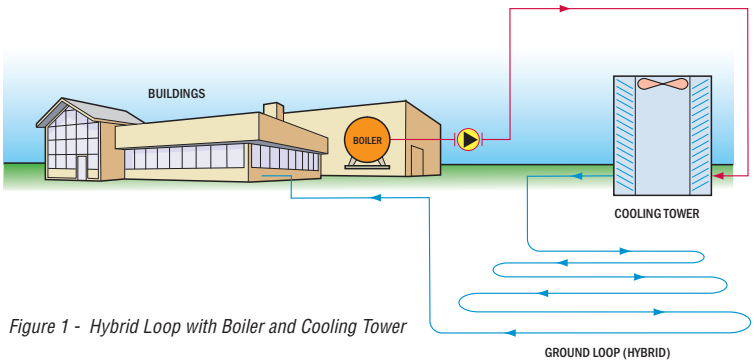

Figure 1 - Hybrid Loop with Boiler and Cooling Tower

The Q-Pump™ is easily incorporated into Desert Aire's TotalAire™ systems by adding one water exchanger. The hot gas reheat coil typically rejects 75% of the THR. The remaining energy is rejected to the water condenser which raises the ground source water loop by 2.5° - 3°F. This added energy to the water loop increases the system's efficiency. In the summer mode the water evaporator is inactive and removed from the refrigeration loop by a solenoid valve. In the winter, the air evaporator coil is inactive and the water evaporator will pull energy from the slightly heated ground water loop. The evaporator reduces the water temperature by 5°to 6°F. Figures 7 and 8 provide a detailed schematic of our Q-Pump™ system and also show how it functions in the summer and winter modes.

A second unique feature to Desert Aire's Q-Pump™ is its sophisticated control logic that automatically adjusts the systems condensing temperature to allow the system to have enough heat on cold winter days to meet the desired leaving air temperatures. Without enthalpy wheels, conventional heat pumps turn off at entering temperatures below 40°F and must utilize auxiliary heating devices to heat the air. During this operating period, these devices have COP's less than 1.0. Desert Aire's Q-Pump™ uses the following sequence to eliminate this problem:

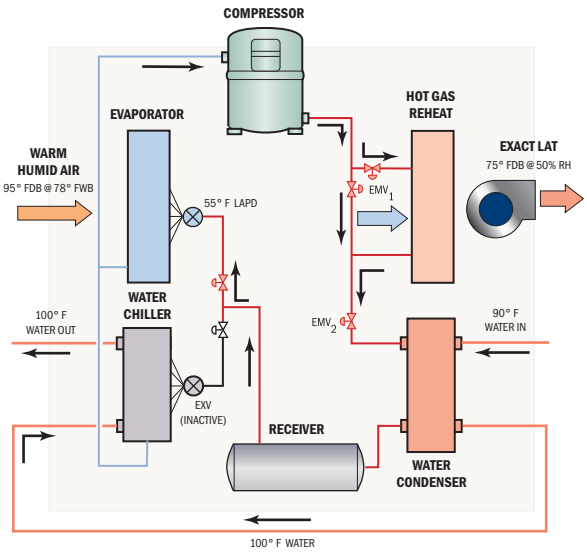

Figure 2 - Q-Pump Schematic with LAT Control: Cooling Mode

- First stage is to adjust the Electronic Modulating Valves (EMV_1) valves to regulate the amount of hot gas to the hot gas reheat coil. This controls the air temperature while keeping power consumption low. COP for this mode will generally fall between 3.5 and 4.0.
- Second stage is to adjust the EMV_2 valve that regulates the systems condensing temperature. Raising the condensing temperature increases the heating capacity of the system, but this increases the electrical energy consumed so at the coldest entering air temperature (e.g. 0°F), the COP would be reduced slightly to approximately 3.0.

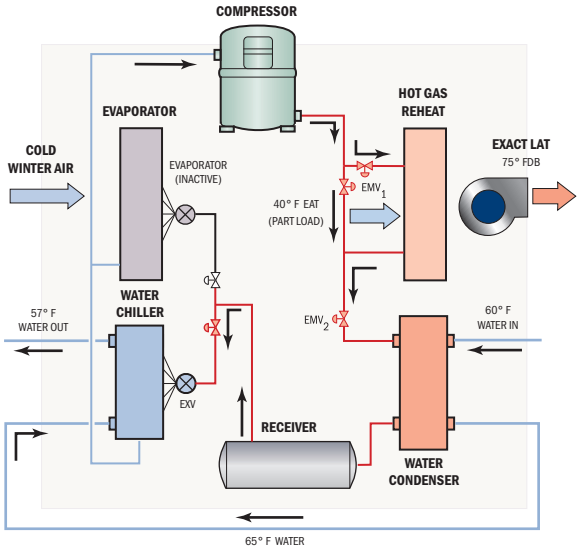

Figure 3 - Q-Pump Schematic with LAT Control: Heating Mode

CONCLUSION

If feasible, the installation of a heat pump into an HVAC application provides many advantages. First and foremost, this type of system provides such an efficient exchange of energy that a facility can expect an average of 50% savings in heating and cooling bills with respect to the 100% outside air dehumidifier.

While the concept of a heat pump is simple, the application requires precise, flawless engineering. Because Desert Aire's TotalAire™ dehumidifiers are specifically designed for energy recovery, a Q-Pump™ can be easily incorporated into the system. Desert Aire's Q-Pump™ provides these unique benefits:

- Lowest operating cost by utilizing dedicated evaporators for the dehumidification and heat extraction
- Control of heating set-points at the lowest entering air conditions
- Automatic adjustment of system set-up using electronic expansion valve

Contact your local Desert Aire representative if you would like more information or assistance about incorporating a TotalAire™ dehumidifier and heat pump into your HVAC system.

HEATING MODE OF OPERATION

OPTIMIZING SOLUTIONS THROUGH SUPERIOR DEHUMIDIFICATION TECHNOLOGY

N120 W18485 Friestadt Road, Germantown, WI 53022 sales@desert-aire.com

Ph: (262) 946-7400 - www.desert-aire.com

Est. 1978 DESERT AIRE