Vertically Designed, DX-DOAS and DX-HOAS

• DX-DOAS - 100% Outdoor Air Systems • DX-HOAS - High Outdoor Air Systems

Dehumidifiers for Limited Footprint

VerticalAire™ is an extension of our TotalAire™ product line. Based upon the TotalAire™ concept, our VerticalAire™ series of products was developed to address all critical IAQ issues. Units for both 100% outdoor air and high outdoor air (30% to 70%) applications use unique control algorithms to provide energy savings. VerticalAire™ provides an IAQ solution for those applications that have limited space for HVAC equipment.

Dehumidify with the Experts ... Desert Aire

Desert Aire's Approach to IAQ

Issues of Indoor Air Quality (IAQ)

Several HVAC professional and trade organizations, such as ASHRAE, have documented the need for suitable indoor air quality. A primary requirement for maintaining proper IAQ is the introduction of outdoor air. Unfortunately, outdoor air will also introduce moisture into a facility, which can create IAQ problems – mold, mildew and the proper environment for viruses and other organisms to flourish. The key to prevent mold formation and growth is to control the relative humidity within the space. However, a standard air conditioner cannot achieve this because it is controlled on temperature alone. Instead, a system must be implemented that can provide full control of both temperature and humidity.

Optimal IAQ Design

Several important IAQ issues must be addressed in order to design the most effective dehumidification system for the application. Desert Aire reviews the following list of criteria when building all custom TotalAire and VerticalAire IAQ units.

Dedicated Outdoor Air Systems (DX-DOAS)

The most energy efficient method for removing unwanted moisture is to use a dedicated outdoor air system that will reduce the dew point of supply air to below 55°F. This approach also helps remove existing moisture inside the facility. A DOAS design can also be optimized to remove the most amount of water from the air at the lowest electrical consumption rate (Moisture Removal Efficiency, MRE) at both full and part-load conditions. Desert Aire manufactures DOAS units under our TotalAire and VerticalAire product lines.

High Outdoor Air Systems (DX-HOAS)

High Outdoor Air Systems (HOAS), condition between 30% and 75% outdoor air making them an ideal alternative to commercial air conditioners. Conventional air conditioners suffer reduced capacity when more than 30% outdoor air is introduced into the unit. In addition, HOAS units deliver accurate space and humidity control, all while meeting minimum EER ratings as required under ASHRAE Standard 90.1 for economizers. This exceptional performance makes Desert Aire's HOAS units extremely advantageous in most regions of the United States.

ASHRAE 90.1 Code

The ASHRAE Building Code 90.1 establishes a standard for energy conservation of commercial HVAC equipment. It states that some systems cannot use new energy to reheat the air; rather, 75% of their energy must be site-recovered. Desert Aire's TotalAire and VerticalAire units comply with this code by using hot gas reheat coils. Our efficient refrigeration design provides the system adequate hot gas reheat in lieu of using the energy for hot gas bypass.

Leaving Air Temperature Control

Desert Aire's IAQ units provide precise discharge temperature by using fully modulating hot gas control valves and proper refrigerant management. Other systems that use solenoid valves and/or liquid sub-cooling loops can control the leaving air temperature to only ±10°F and typically are closer to ±20°F. In addition, these systems do not comply with code 90.1. They require new energy to trim the leaving air temperature to avoid overcooling of the space. The accuracy of the system also directly affects the cost of operation. Costs rise when new energy is required to adjust high temperature fluctuations in order to meet preset temperatures. The table below shows the potential increase in energy consumption that can occur at different control accuracies.

ACCURACY TOLERANCE	POTENTIAL ENERGY CONSUMPTION
±0.2 °F	Base
±2.0 °F	10%
±5.0 °F	25%
±10.0 °F	50%

In addition, people can sense temperature differences greater than ±2.0°F. Therefore, the greater the temperature swing, the more uncomfortable the occupants will be. (See Figure 1.)

Double-Wall Construction

Fiberglass insulation is known to cause IAQ problems. It tends to wick water from the air and promotes the growth of mold and bacteria. Our TotalAire and VerticalAire systems avoid this problem by using either closed cell foam or internal galvanized liner. Most importantly, our systems don't add to the IAQ problem.

Air Separated Coils

If a hot gas reheat coil is installed too close to the evaporator coil, re-hydration can occur. Water that forms on the evaporator coil can be blown onto the hot reheat coil, and thus be converted back into vapor and returned to the space. This completely negates all dehumidification efforts and fails to meet basic IAQ design requirements. Plus, the system ends up removing less moisture at a higher electrical cost. That's why we design our IAQ units with adequate separation between the outlet face of the evaporator coil and the inlet face of the hot gas reheat to prevent re-hydration. (See Figure 2.)

Filtration

Outdoor air is full of many airborne particles and pollutants. Filtration is essential to prevent dirt from accumulating on coils as well as to avoid contaminating indoor spaces. When 1- or 2-inch wide filters are used in systems, they must be frequently replaced. Therefore, our IAQ units are equipped with a minimum of 4 inch, pleated filters to reduce filter maintenance.

Full-Size Condensers

Our D/X-based systems use the ideal control strategy that can provide first-stage cooling by delivering colder air to the space. Since the compressor must be energized for dehumidification, the unit can meet the space's part load sensible requirements. As a result, our units can help reduce the size of the main air conditioning system.

Single Source Responsibility

Because the compressor is internal on our TotalAire and VerticalAire units, the entire system can be factory-tested, providing single-source responsibility and increased quality assurance.

Options and Applications

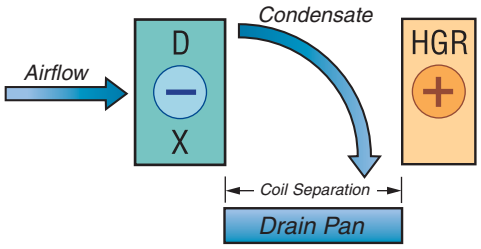

Figure 2 - Re-Hydration Prevention

Optional *Q*-Pump™ Water-Source Heat Pump

A heat pump "pumps" energy from a hot source to a cold source for heating purposes, while also pumping energy from a cold source to a hot source when cooling is required. Because of the innovative design of Desert Aire's *Q*-Pump™ heat pump, facilities can now achieve significant energy efficiency through improved energy recovery.

Non-Reversing Valve Technology

Desert Aire's *Q*-Pump™ system uses a four-element refrigeration system to overcome the typical problems that two-element reverse cycle systems encounter. In addition to the standard evaporator and reheat coils, the *Q*-Pump™ uses 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. This design maximizes MRE and COP, providing the lowest operating cost to the user.

Winter LAT Control

Conventional reverse cycle systems can only provide air at fixed temperatures. They cannot control the amount of heat that's added to the air stream. This either overheats or under-heats the air, requiring new energy to meet preset temperatures. The *Q*-Pump™, however, precisely controls the amount of heat added to the air eliminating the need for other energy sources. Any extra energy is added back to the water loop to enhance the system's COP even greater.

Eliminating Preheat of Supply Air

The *Q*-Pump™ can heat 100% outdoor winter air without the need for a separate auxiliary heat source such as gas. Our system is effective down to 15°F winter design temperature as compared to a conventional system's minimum of 40°F.

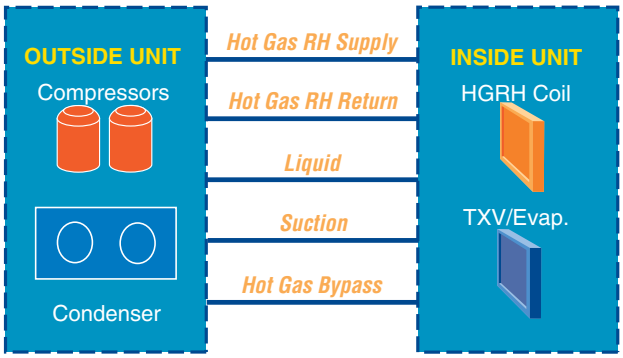

Figure 3 - Competition's Line Set Schematic

Auto Season Change-Over

Conventional heat pumps must stop the compressor to change from heating to cooling. With the compressor off, untreated outdoor air is then delivered to the space. The *Q*-Pump™'s creative design avoids this problem and automatically makes heating and cooling changes without losing LAT control.

Incredible System - Phenomenal Results

The real advantage of the *Q*-Pump™ is that it controls LAT in both the cooling and heating modes. This truly meets all energy codes including ASHRAE 90.1 and achieves EER's of 14+ and COP's approaching 6.0. By incorporating a *Q*-Pump™ with an HVAC system, a facility can expect up to 50% savings on its heating and cooling bills with respect to the VerticalAire™ dehumidifier.

(For full details, read *Technical Bulletin 21 – Heat Pump Design for 100% Outdoor Air Systems.*)

Split System Advantages

A VerticalAire™ unit houses the compressors in the air handler section, not in the outdoor condenser. This provides several advantages. First, only two refrigerant lines need to be field piped: hot gas and liquid return. This is three less than the five line-sets required by systems with compressors in the outdoor condenser: hot gas, liquid return, hot gas bypass, hot gas reheat supply and return. A five pipe system is also limited to a maximum line distance of 25 feet. (See Figures 3 and 4.)

Secondly, a VerticalAire™'s power supplies are greatly reduced in size. This is because the largest loads (compressor and electric auxiliary heat) are in the same location of the same unit, but do not run simultaneously. If the compressor is external, then similar sized power runs must be made to both elements, thus increasing power consumption.

Water Cooled Option

Because of its design, VerticalAire can easily be specified in the same enclosure as a water-cooled system, thereby eliminating any exterior refrigerant piping.

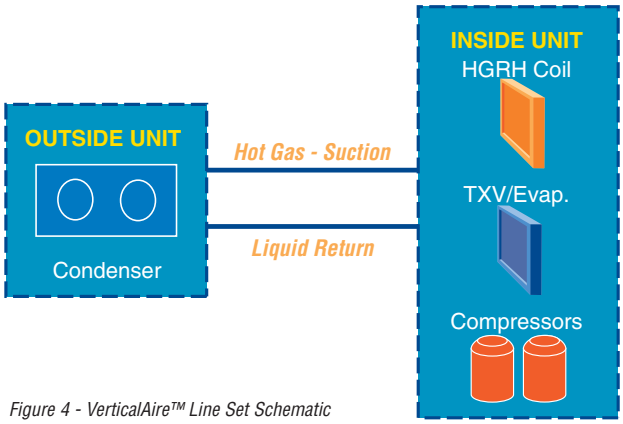

Figure 4 - VerticalAire™ Line Set Schematic

Standard VerticalAire™ Series Features

Filters
- 4" deep extended surface, 30% atmospheric efficiency

Evaporation Coil
- raised lance fins, rifled tubes maximize moisture removal

Drain Pan
- stainless steel pan minimizes corrosion
- sloped design avoids hazardous puddling

Refrigerant Reheat Coil
- sized for neutral LAT (65°F to 80°F) with ± 2.0°F control
- adequate coil separation avoids re-hydration

Scroll Compressor
- state-of-the-art compressor technology for highest efficiency and reliability
- quietest operation for less noise
- units 8 tons and larger, multiple compressors are staged to match the load

Fans
- forward curved centrifugal blowers or plenum fans

Electrical Service
- single point connection, including heat – all units

Cabinet Construction
- double-wall construction standard on 20, 25 and 30 ton units
- corrosion-resistant G90 galvanized construction
- all serviceable elements accessible from front and side of unit

Insulation
- closed cell foam or polystyrene board in double-wall construction
- superior to fiberglass insulation – eliminates fiber-release into air
- meets ASTM mold, mildew, moisture resistance specifications

Air- or Water-Cooled and *Q*-Pump™ Heat Pump
- dissipates captured heat outdoors or into water loop
- available in split or packaged configurations (package is water-cooled)

Leaving Air Temperature Control
- supply air temperature controlled to ±2.0°F
- substantial energy savings and ASHRAE 90.1 compliant
- conditioned outdoor air can be introduced directly into space

Additional Options Increase Flexibility
- optional coil coatings available for corrosive environments
- single phase available on 4 and 5 ton units
- optional power disconnects (fused and non-fused)
- contact factory for non-standard options
- units available in 4 - 30 tons

DESERT AIRE

Dehumidify with the Experts!

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Desert Aire factory assembles and tests all units as systems, not components.

All referenced publications are available as PDF files at www.desert-aire.com. Supportive literature includes:

- ***Application Note 15***
- ***Technical Bulletin 16***
- ***Technical Bulletin 19***
- ***Technical Bulletin 20***
- ***Technical Bulletin 21***

Desert Aire's VerticalAire™ system is a high-quality, cost-effective 100% outdoor air dehumidifier that's designed for tight spaces. VerticalAire™ meets stringent ASHRAE 62 and 90.1 standards yet can fit into confined mechanical rooms. Plus, VerticalAire™ can be incorporated into geothermal and building heat loops using Desert Aire's new *Q*-Pump™ heat pump design.