

Desiccant Systems Find New Friends

AT A GLANCE

- ▶ Often, conventional cooling cannot handle humidity levels
- ▶ Retail, hospitality, pools and rinks ideal candidates
- ▶ Engine heat can regenerate desiccant
- ▶ Reduce overall energy usage

We were able to dehumidify and cool that space to the point where lots of customers came back and their sales went up,” says John Hayden, Director of Design-Build Services, Frey Lutz Corp.” He is talking about improvements made using desiccant dehumidification in a tropical fish retail store in Lancaster, Pennsylvania.

“When you went in that fish room it was like a jungle,” recalls Todd Christ, Industrial-Commercial Utilization Engineer at UGI, the gas utility serving the Lancaster area. Christ is a fish enthusiast who also understands building comfort systems. He says moisture in the room was also damaging the building structure. “The walls were falling apart, the ceiling was sagging,” he reports.

OVERWHELMING HUMIDITY LEVELS

The facility had electric rooftop air conditioners that simply were unable to manage the high moisture load from hundreds of tropical fish tanks placed under hot display lights. Conventional air conditioning couldn’t keep the retail space comfortable. Addition of a gas-fired desiccant dehumidification unit made the space comfortable again.

Conventional electric air conditioning technology is one of those things that

makes sense in principle, but sometimes has shortcomings in practice. The idea is that warm, moist building air is passed over a coil chilled either by refrigerant or water. Sensible heat in the air is reduced by contact with the coil, and latent heat (moisture) in the air condenses out as water. The output is supposed to be chilled, dry air. The process can work, but there are several “ifs”.

OVER-COOLING A COMMON PROBLEM

If the principal problem with room air is the humidity level, this process may result in over-cooling of the discharge air in order to extract the humidity. The only solution to this with a conventional system is to reheat the discharge air to prevent excessively cold drafts or temperatures below the setpoint. Reheating is highly energy intensive

In other cases, such as the tropical fish store cited earlier, a building’s high moisture loads may simply overwhelm a conventional cooling system. A chiller or air conditioner adequately sized for dehumidification is far larger than required for simple cooling, is expensive to install and operate, and takes up valuable floor space.

ENTER THE DESICCANT SOLUTION

An alternate approach that resolves these problems is to use a gas-fired desiccant dehumidification system to manage moisture levels, both in entering ventilation or makeup air, and in circulating building air. By allowing the conventional air conditioning system to work on a controlled volume of dry air, it can maintain ideal comfort and humidity levels.

The principle of desiccant dehumidification is that certain chemicals can attract and hold moisture from an air

stream. The desiccant material can then be heated to cause it to release the moisture into an exhaust stream. The desiccant then recycles to repeat the process. Desiccant dehumidification systems use either a liquid desiccant solution or a dry desiccant material on a medium similar to a rotating filter. In both cases heat, commonly from a natural gas-fired source, is used to release the moisture.

SUPERMARKETS PRIME CANDIDATES

Certain buildings are especially good candidates for desiccant dehumidification. These include supermarkets, because of their open refrigeration cases and large exposures of moist produce, as well as other retail businesses with high latent loads – for example the pet store. Other facilities that are good candidates for desiccant cooling are ice arenas, indoor swimming pools, large florist or garden shops, or any areas where there is a high requirement for ventilation air in a humid climate.

An example of this last case might be a restaurant or club with a high ventilation requirement for tobacco smoke removal or to maintain a positive air pressure in a food service area. In industrial facilities, such as candy or snack food manufacturing, or pharmaceutical packaging, desiccant systems are widely used to meet a special need for tight humidity control.

DEHUMIDIFY INCOMING AIR

A common approach is to install a desiccant wheel in the incoming ventilation airflow, before the air reaches the standard air handling and air conditioning equipment. The effect of such an installation is to actually increase the effective capacity of the cooling plant. Desiccant systems are often installed on the build-

ing rooftop, adjacent to a rooftop air conditioning unit. A desiccant unit can also be installed to treat circulating return air from the building, dramatically reducing its humidity load before it reaches air handlers and chilling coils. In some cases multiple units are installed to perform all of these functions.

LIQUID DESICCANT SYSTEMS FOR PRECISE CONTROL

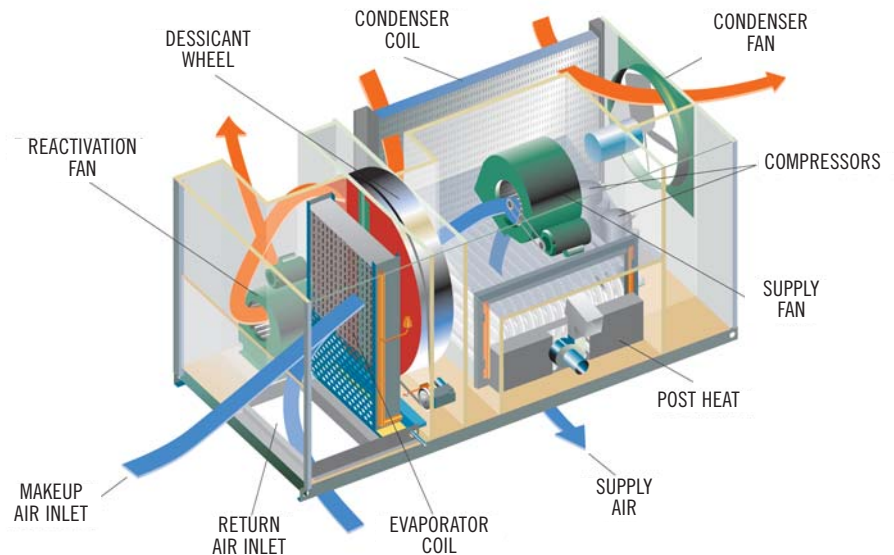
In addition to solid desiccant systems on rotating wheels, another approach is to use a liquid desiccant which is exposed in a cascade or spray arrangement to building or ventilation air. Liquid desiccant systems are widely used in large installations or where a precise level of dehumidification is needed, such as in a manufacturing operation.

Desiccant dehumidification systems can easily be adapted to operate using waste heat from other processes, including air conditioning. An example of a well-conceived desiccant dehumidification system utilizing byproduct heat is the Hockey Outlet, a year round, full-service ice arena near Buffalo, New York. The facility recently added a new 8.1-liter Energen Technologies natural gas-fired engine compressor that generates 130 tons of ammonia refrigeration at 13°F to maintain the ice rinks.

ENGINE HEAT DRIVES DESICCANT WHEEL

Heat recovered from the engine produces hot water for regenerating a Munters IceAire™ enthalpy wheel desiccant system to remove excess humidity, a common problem in skating facilities. “We take the heat that normally would be wasted from the (engine) jacket water and also part of the exhaust heat, and put it to work,” says Joseph Merckel, President of Energen Technologies, Inc. Energen Technologies provided overall concept and design to this turn-key project, designed and manufactured the refrigeration system, and helped to finance it through an energy service contract.

HUMIDITY CONTROL UNIT — HCU-3000



After the heated water is used to regenerate the desiccant wheel, it then flows to a hot water tank for use in showers and restrooms. In addition, the Zamboni machine uses 100 gallons of this hot water each time it resurfaces an ice rink.

MAJOR ELECTRIC USE REDUCTION

The new refrigeration system and the associated desiccant dehumidification equipment save rink owner Tim Igo close to 500,000 kWh of electricity annually. They also reduce monthly electric demand by as much as 90kW, according to Joseph Merckel. “A large percentage of the cost of operating the facility is energy,” he explains. “And thanks to firing the dehumidifier with waste heat, any increase in the cost of natural gas also increases the value of the recovered energy,” Merckel adds. “This helps provide some future economic stability in the face of our changing energy markets.” Including heat recovery, the new refrigeration system saved \$2,000 to \$3,000 monthly during its first year, Merckel says.

IMPROVES INDOOR ENVIRONMENT

“It’s not only reduced the owner’s energy costs, but it has improved the air quality in the rink by reducing humidity,” says

David Burke, General Energy Consultant at National Fuel Gas Company, the local natural gas supplier. National Fuel provided some funding to the project to demonstrate gas engine-driven chilling technology. Burke adds “Their (electric) equipment was near the end of its expected life cycle. On a life cycle basis, it (the new natural gas refrigeration system) was a more cost favorable alternative to electric chillers.”

A gas-fired desiccant dehumidification system can not only save energy dollars, but it can handle humidity levels that a typical conventional electric air conditioning system cannot. Desiccant systems are especially effective in buildings where the latent load is much higher than the sensible cooling requirement. For many applications they are the systems of choice. It may be worth your while to ask your system designer to include the desiccant option in your building construction or renovation plans.

MORE INFORMATION

CONCEPTS AND DESIGNS	www.conceptsanddesignsms.com
KATHABAR	www.kathabar.com
MUNTERS	www.munters.us
NOVELAIRE	www.novelaire.com
SEMCO	www.semcoinc.com

MORE INFORMATION ON DESICCANT DEHUMIDIFICATION:
www.gasairconditioning.org