the blue bulletin
GAZ MÉTRO AND ARENAS
April 2004

GazMétro
life in blue

Better Arena Air Quality using Natural Gas Desiccant Dehumidification

by Sébastien Lajoie *

At a time when air quality has become a major issue, desiccant dehumidification is a technology that it may be worth your while exploring. This is especially true in arenas, where air quality problems are often encountered – and abundantly documented.** Unlike conventional technology, desiccant dehumidification helps maintain acceptable fresh air levels, which leads to greater user comfort, increased protection against structural corrosion, and better ice quality.

As an arena manager, you are certainly concerned about excess humidity in your arena. So, whenever possible, you avoid bringing in outside air that could cause major condensation-related structural problems. That is probably why the industry doesn't choose to bring in air mechanically, as do other buildings such as gyms, offices, pools, schools, etc. Why is this exactly? Is the recommended 40% mid-season indoor humidity level for arenas difficult to achieve with conventional dehumidification technology? As we'll see below, this is not true.

Conventional mechanical dehumidification

Conventional dehumidification systems include heat-pump-type systems (i.e., mechanical compression systems that use direct expansion coils as evaporators) and systems that use brine pumps to cool the ice. These systems dehumidify the air by condensing the water vapor it contains.

However, there is a lot of water vapor in an arena. It is mainly produced by the melted ice, the ice surfacer, the players, and outdoor air infiltration. The difficulty in achieving the desired 40% humidity level with this equipment is that it operates in a climate range close to the freezing point of water vapor. In concrete terms, arena climate conditions are similar to those of home freezers, where the frost is from water vapor condensing on the evaporator. It's therefore not surprising to see fog in many arenas at some times of the year.

* Sébastien Lajoie, Eng., is a Technical Advisor with DATECH Group, Gaz Métro. He can be reached at 514 598-3590.

** *La qualité de l'air dans les arénas,* http://www.rbq.gouv.qc.ca/dirgrandpublic/dirpensezSecurite/air.asp

A solution: Natural gas desiccant dehumidification

Problems with air quality, as well as those caused by moist air in arenas, can be corrected by using a natural gas-regenerated desiccant. This type of equipment does not use the condensation principle to remove water vapor from the air; rather, it absorbs it and discharges it outside the arena. The advantages can be summed up as follows:

- Your customers' comfort is improved, with a 40% humidity rate.
- You can let in more fresh air and thus improve air quality in your arena (ASHRAE 62-2001 calls for 2.5 L/s fresh air per m^2 (0.5 cfm/sq. ft. of ice) and 7 L/s (15 cfm) of fresh air per spectator).
- Energy savings can be achieved as a result of the reduced cooling load on the ice refrigeration system due to the lower relative ambient humidity. This reduces power consumption and power demand. (In some cases, these savings can be up to 27 tonnes of refrigeration for an arena that is open year-round. The benefits are even more noticeable if the arena uses a dehumidification system connected to its brine loop system.)
- You can save on structural maintenance, as the building structure is less exposed to condensation.
- Ice quality is improved due to lower ambient moisture condensation.

A technology increasingly used in recreation arenas

Although some National Hockey League (NHL) arenas already use this technology, natural gas desiccant dehumidification is still not well known in Québec. The Centre sportif Dollard-St-Laurent arena in the Montréal Borough of LaSalle, which did the installation work in 2004, and the Campeau Arena in Gatineau, both opted for this technology, much to the satisfaction of the managers.

At the Campeau Arena, an A-10 Munters unit was installed at a cost of $60,500 and put into operation in January 2001. This new installation generated very appreciable annual savings while lowering arena humidity to the required comfort level. Air and ice quality were also improved, to the great satisfaction of users and managers.

Desiccant dehumidification system
at Campeau Arena in Gatineau

Improving air quality: A necessity for arenas

Bringing fresh air into arenas is essential, and to do so problem-free, natural gas desiccant dehumidification is unquestionably the most appropriate solution. Also, to ensure better elimination of CO (which is as heavy as air) and have the air mix well, care will be taken to open certain rink doors during intermission, according to certain safety instructions.

Choosing a dehumidifier of the right size is also essential in order to obtain the desired benefits. That is why the model of dehumidifier has to be selected depending on whether the arena is open year-round or only part of the year. In addition to the energy savings generated by this technology, you need to consider **potential revenue growth** by extending the arena's use to warm-weather activities.

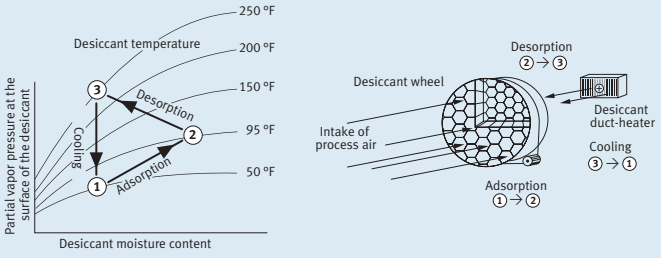
Réf. : – NJ Banks. 1990. *Desiccant Dehumidifier in Ice Arena;*
– ASHRAE Refrigeration Handbook – *Ice Rinks;*
– Applications Engineering Manual for Desiccant Systems, *American Gas Cooling Center.*

DESICCANT DEHUMIDIFICATION

This technology offers the immense advantage, among others, of providing precise control over building humidity levels, independently of temperature, particularly at the dew point.

A honeycomb-type desiccant wheel is made of a semi-ceramic material impregnated with a desiccant substance. The material, which resembles corrugated cardboard, is rolled into a wheel shape. The wheel is activated by a motor that allows parts of the wheel to pass alternately through the section where air to be dehumidified circulates (where the wheel adsorbs the humidity) and the other section where the reactivation air circulates (where the moisture is extracted from the wheel).

The diagram shows the various steps of the adsorption cycle. The cycle starts at point 1. As the desiccant in the wheel adsorbs the moisture, it becomes saturated and the partial vapor pressure at the surface changes. This point corresponds to number 2 on the diagram. The wheel then passes through the section where the reactivation air circulates. As the reactivation air heats the wheel, the partial vapor pressure at the surface of the desiccant increases, so it can then release the water adsorbed in step 1. This takes place between points 2 and 3 on the diagram. The heated part of the desiccant then passes back through the section where the air to be dehumidified is circulating, and a portion of this air again cools the wheel, enabling it to adsorb more moisture. This takes place between points 3 and 1 on the diagram, and the cycle starts again.
(Pierre Goulet, Eng., DATECH Group)



For more information, contact
one of our Sales Representatives.

GazMétro
life in blue