DXAIR INDOOR POOL DESIGN GUIDELINES
WASTE VENTILATION (EXHAUST FAN SYTEMS)

ASHRAE HVAC APPLICATIONS MANUAL STATES:
"Natatoriums with fixed outdoor air ventilation rates without dehumidification generally have seasonally fluctuating space temperature and humidity levels. Systems designed to provide minimum ventilation rates without dehumidification are unable to maintain relative humidity conditions within prescribed limits. These systems may facilitate mold and mildew growth and may be unable to provide acceptable indoor air quality. Peak dehumidification loads vary with activity levels and during the cooling season when ventilation air becomes an additional dehumidification load to the space".

A. *WASTE VENTILATION SYSTEMS & WHY THEY DON'T WORK*

A major problem with conditioning swimming pool enclosures is the relatively high operating costs of maintaining acceptable conditions. Some type of cost effective energy recovery devices must be considered when the heating, ventilating and/or cooling system is designed. One method for controlling humidity is a ventilation system (EXHAUST FANS/furnace), using drier outdoor air to replace humid air. However:

1. A considerable amount of heat is needed to temper the outdoor air during cold weather before introducing it into the pool environment and when temperatures are intermediate, this system may not control humidity. Generally these systems lack the proper air turnover rate and lack the proper duct work/air delivery system for the enclosure.

2. During hot weather the system cannot control temperature or humidity. The HVAC equipment to accomplish this is costly both to install and to operate. It can consist of a pool water heater, and large, noisy exhaust fans. Also included with these systems are high capacity heaters to bring the large volume of incoming outside air up to design temperatures, and/or large capacity cooling equipment to cool and dehumidify the air in the summer. When you add the proper controls, this can be the most expensive of all dehumidifying alternatives. Remember, recoverable energy consists of both the sensible and latent heat of the exhaust air. The latent component can be a very sizable part of total recoverable energy, therefore a heat recovery device that can extract both sensible and latent heat should be considered.

Since a ventilation system can only provide effective humidity control if the outdoor air is reasonably drier than the indoor air, it will not perform well in humid weather (i.e. 90 Degrees Outside with 95% Humidity and it is raining). Therefore, a mechanical dehumidification system will be required to control humidity in the enclosure when the outdoor air approaches the moisture content of the indoor air.

B. OPENING DOORS/WINDOWS OR RETRACTABLE WINDOWS OR SKYLIGHTS TO CONTROL HUMIDITY IS NOT AN EFFECTIVE MEANS TO CONTROL THE POOL ROOM ENVIRONMENT.

One traditional approach to dealing with this humidity is to simply open all the doors and windows in the pool area and let nature dehumidify with drier outdoor air. This passive "mother nature" approach **might** work on days when the outdoor air is at the same temperature as that desired in the pool area and with a lower relative humidity. These conditions rarely exist, however. This process can only work when the outside air is cool and dry enough to allow for humidity control. In the winter time, an indoor pool without a dehumidification system will be cool and clammy, because the air temperature in the space will not be heated warm enough to be comfortable. During spring or fall, the outside air is cool and dry enough to use this process, but if the air is too cool (say 20 or 30 degrees F), an enormous amount of energy is required to heat up the air to design space temperature.

Pre-fabricated/manufactured structures with opening or retractable panels require even more control over the environment; due to the high heat loss and heat gain of these structures. Example: when opening these panels — If the outside air temperature is 85 degrees and the humidity is 90%, you bring in this 85 degree air with 90% Relative Humidity, making it impossible to control humidity.

With waste ventilation (or exhaust fan) type systems, there will be no cooling of the space. You will lose both temperature and humidity control within the space. In the spring you'd want to open doors and windows and leave them open. The space temperature drops in the evening, increasing evaporation from the water. At this point the windows are shut, and fans turned on to control humidity. But to save energy, the humidity is allowed to increase to 80 or 90%. This results in an uncomfortable and unhealthy environment for the pool user, that coupled with the aggressive nature of chemicals and chlorine can result in structural damages.

C. HOW DOES HUMIDITY AFFECT YOUR POOL ENCLOSURE?

Humidity and subsequent condensation on ceilings, windows, wall surfaces etc. in a pool enclosure without proper dehumidification can damage the structure by being absorbed into the walls, ceiling, & structural members of the room. These gallons of moisture can permeate an indoor pool enclosure creating problems where it cools to dew point and condenses. Areas where the moisture carried in the air condenses on cooler surfaces and becomes havens for fungus, mold, mildew and rot. Gaps or tears in vapor barriers give this water vapor access to structural members and insulation, where hidden condensation deposits accumulate unseen for years. Add unavoidable decay accelerated by mold and fungus to the fact that wet wood has a fraction of dry wood's strength, and long term building problems, premature structural and equipment failures are inevitable. Even steel beams can give way after years of uncontrolled moisture.

D. HOW DEHUMIDIFICATION SYSTEMS WORK TO CONTROL THE POOL ENVIRONMENT

Several factors come into play when determining evaporation rates. The rate of evaporation is driven by your target relative humidity as well as the evaporation rate which results from the water and air temperatures to be maintained. Typical design parameters for indoor pools are:
Relative Humidity: 50-60%RH
Pool Water Temperature: Commercial 78-80F
Residential 82-84F
Therapeutic: 86-90F
Whirlpools/Spas: 104F
(Note: the above may be considered typical design: however, each customer has their own unique requirements which may fall in or outside of these parameters. We will work with each client's temperature design to size systems properly.)

Evaporation rate is determined by the size of the pool surface area, the temperature of the water, the air temperature being maintained, and activity factors within the envelope. Evaporation rate is typically measured in pounds/hour of moisture added to the air per hour. Like a pot of boiling water, water evaporates into the air and rises toward the ceiling; this moisture stratifies at the ceiling level, and on glass and other surfaces. The dehumidifier senses the humidity rise and begins extracting moisture (and latent heat) by pulling this warm moist air into the high Return Air Duct. The recovered heat from the dehumidification and cooling cycles can be used to heat the pool water or the room, whichever is calling for heat (called heat recovery or pool heat reclaim). The moisture removed from the air then goes down a condensate drain.