Finalizing Natatorium Design

Description

FINALIZING NATATORIUM DESIGN

CHAPTER SEVEN

At the core of every successful natatorium design is a system that provides the operator the year-round conditions they expected while meeting ASHRAE design standards, satisfying local codes, and being as energy efficient as possible.

Understanding that product flexibility is essential allows the designer to work through the project-specific issues without compromising design. The overall performance of a natatorium will be directly impacted by the number of deviations and compromises taken in the design stage.

Once all the design parameters have been established, the only remaining decisions will be what the designer would like incorporated into their dehumidifier and what they want provided externally. Some of the configurations available from most manufacturers include unit-mounted heating coils, exhaust fans, heat recovery packages, weatherproof outdoor cabinets, and a variety of heat rejection options. The project-specific details generally dictate what is the most appropriate.

DESIGN THE SYSTEM WITH IAQ IN MIND

Ensuring that the system will deliver good indoor air quality is quite possibly the most important design consideration of all.

There are two key design aspects to delivering good IAQ:

1. Ensure that chemical off-gassing is reduced, controlled, or, ideally, eliminated. It cannot be stressed enough that the Evacuator system, as well as any waterside systems that reduce chemical off-gassing, are essential considerations to helping deliver good IAQ.
2. Ensure the air distribution system supplies sufficient air to the breathing zone, including across the water surface.

STEP 1: OPERATING CONDITIONS

The designer must discuss with the owner the desired pool water temperature, room temperature, and relative humidity.

Operating conditions have a tremendous impact on the entire design and cannot be changed by a large degree after the fact. It is critical that the designer educate the owner on the implications of their operating temperature choices. Maintaining the room air temperature 2-4Â°F above the pool water temperature will help reduce evaporation â?? but the temperature must still be comfortable to patrons. Reduced evaporation in turn reduces the pool water heating requirement.

STEP 2: SUPPLY AIR

Calculate the supply air requirement of the space based on the room volume. The target air change rate per ASHRAE is 4-6 volumetric air changes per hour, with a 6-8 air change rate in spectator areas. This calculation establishes the entire air handling system.

- Supply air must move down into the breathing zone. It is critical for comfort and good IAQ that the treated supply air reach the pool deck and occupants.
- If using a fabric duct, the same air distribution and duct design rules apply. Supply air must be directed to where it is needed, or IAQ problems will result.

- Ensure the return duct location complements the supply air duct location and promotes a good air pattern. In a large natatorium, several return air grilles might be required to achieve a good air pattern in the space.
- Be careful to avoid air short circuiting or placing supply diffusers too close to the return duct opening. This can ruin the effectiveness of the supply air and give any return duct mounted sensors false readings.

STEP 3: OUTDOOR VENTILATION PER LOCAL CODES

The baseline outdoor ventilation air requirement could be any of the following:

- 0.48 CFM/ft2 of water surface area and wet deck for a regular pool
- 0.06 CFM/ ft2 for the rest of the dry deck
- If spectators are in a seating area, add 7.5 CFM per spectator during swim meets.

Introducing more outdoor air than codes require is not recommended. In winter, it will increase space heating and pool water heating costs significantly. Too much outdoor air in winter can also lower the relative humidity levels to uncomfortable levels for the patrons.

- Outdoor air must be filtered.
- Ensure the airflow is balanced when the system is commissioned.
- Preheat the outdoor air to 65Â°F if condensation is a concern. A glycol heat recovery loop is a good means to accomplish this while also saving the operator in heating costs.
- Thermally insulate the exterior of the outside air duct.

STEP 4: EXHAUST AIR

The room should have a slight negative pressure. ASHRAE recommends 0.05 to 0.15 inches of water column. A good rule of thumb is to exhaust 110% of the outdoor air CFM. A well-located exhaust fan can significantly improve the air quality in the space. If the space has a spa or whirlpool, the exhaust air intake grille should be located directly above it. This source captures and extracts the most contaminant-laden air before it can diffuse into the space and negatively impact the room air quality.

- The exhaust fan can be installed remotely or within the dehumidifier.
- Energy recovery from the energy rich exhaust air to outdoor air should be considered.

STEP 5: LOAD CALCULATIONS

The natatorium needs to be heated, cooled, and dehumidified. This requires the accurate calculation of the following loads:

- Building envelope sensible heating load that includes outdoor air
- Building envelope sensible cooling load that includes outdoor air
- Latent load [pool evaporation, outdoor air (summer), and spectators]

All manufacturers offer the ability to include the heating coil inside the dehumidifier. The coil should be fully corrosion protected and suitable for a pool environment. Manufacturers generally offer unit-mounted control valves as well.

Care must be taken when considering gas heating. If chlorine from the natatorium is allowed to mix with combustion gases, hydrochloric acid (HCl) forms and is very corrosive. It is a best practice to select a gas heat option that has been engineered to fully prevent this from ever happening.

STEP 6: CONDENSATION AND VAPOR MIGRATION

Establish the space dew point temperature based on the desired space conditions. Once established, the designer must identify all potential condensation spots in the building. A typical pool design of 82Â°F 50-60% RH has a peak dew point of 67Â°F. Some applications see dew points over 75Â°F. Any surface temperature below the dew point of the space will condense moisture. The higher the dew point, the bigger the challenge.

A vapor retarder restricts the rate of water vapor diffusion through the ceilings and walls of a building when below dew point temperature occurs. Failure to install the vapor retarder in the proper location will result in condensation within the structure and lead to structural failure. Always ensure the vapor retarder is sealed at all the seams.

- The vapor retarder must be on the warm side of the dew point temperature in all walls, ceilings, and floors.
- All exterior windows, doors, and skylights must be fully blanketed with warm supply air. 3-5 CFM/ft is recommended.

STEP 7: ENERGY & LEED CONSIDERATIONS

The energy consumption and performance implications of the building type and operating conditions must be discussed with the owner.

OPERATING CONDITIONS

Operating conditions have a tremendous impact on operating costs. It is critical that the owner understand that **at the same water temperature, a pool in a room at 78Â°F 50% RH will evaporate almost 35% more than that exact same pool in an 85Â°F 50% RH room**. The pool room should be kept as warm as possible and also be comfortable to patrons. Reduced evaporation reduces the dehumidifier size and runtime as well as the pool water heating requirement.

HEAT RECOVERY POOL WATER HEATING

The dehumidifierâ??s pool water heating option should be considered. It is site-recovered energy with a very attractive return on investment. The use of the pool water heating option also satisfies ASHRAE Energy Standard 90.1.

Ensure that the pool water circuit is designed to allow water to be delivered to the unit reliably.

- Provide a separate circulating pump.
- Use the controls provided by the dehumidifier to control the auxiliary water heater operation.

- Install the auxiliary pool water heater downstream of the dehumidifier for backup heating.
- Ensure the pool water chemicals are introduced downstream of the unit, auxiliary heaters, and pumps.

HEAT RECOVERY ON MINIMUM OUTDOOR AIR AND EXHAUST AIR

Outdoor ventilation air is essential for maintaining good IAQ in the pool and is a code requirement. The natatorium also needs to be maintained at a slight negative air pressure, so warm energy rich air can be exhausted. These two air streams at vastly different conditions present a perfect opportunity for heat recovery.

It is a best practice to leverage heat recovery between these two air streams. A glycol runaround loop has many benefits over other methods of heat recovery, and is recommended.

Adding the glycol runaround loop heat recovery option to a dehumidifier in a cold climate application will typically pay for itself after one year.

- The heat recovery device should be suitably protected from corrosion and freezing.

CONDENSATE RECLAIM

Verify with local codes whether condensate return to the pool is allowed. While condensate is generally considered gray water, this condensate is actually cleaner, and can help realize considerable water savings if introduced upstream of the filters and chemical treatment.

- If allowed by local codes, the condensate reclaim from the dehumidifier can be the equivalent of one pool fill annually.

REFRIGERANT REDUCTION

If a compressorized system is being used, efforts should be made to minimize the system refrigerant charge and reduce the refrigerant piping complexity. Fluid-cooled systems are a popular option because of their inherently low refrigerant charge and simple installation.

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