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Desert Aire & USA Swimming - Aquatics Webinar - Answers to Your Questions

Answers to Your Questions from the Webinar

Thank you for your interest in our aquatics webinar that we co-presented with USA Swimming® on Wed., May 14th, 2008. Whether you viewed the live webinar in May or re-played it from HPAC Engineering's website, we hope you found our presentation valuable and informative.

During the webinar, our speakers, Harry Milliken III of Desert Aire and John McIlhargy of USA Swimming®, received 49 questions of which they were able to answer only 11 during the presentation.

However, we've taken the time to review and combine many of the the remaining questions in order to provide written responses which you will find below.

Here are our responses to the questions that we received during the webinar.

Natatorium/Pool Room Design 1

Q1. Have you ever dealt with a wood frame pool building with an attic in a residential community center?

A1. We have been involved with many pool rooms that have wood frames. It is important that the attic be carefully sealed off from the pool room and appropriate products used on the pool side of the room (e.g. green board instead of standard drywall). Please see the points in response #3.

Q2. On pools that are made of precast, what do you typically recommend for a vapor barrier?

A2. A high quality vapor proof paint (e.g. Watertite™ by Zinsser) must be applied to the concrete walls and ceilings to prevent migration of the moisture into and through the material.

Q3. What is the ideal construction of a natatorium?

A3. This is impossible for us to answer because it depends on the owner's aesthetic

requirements. From a pure engineering viewpoint, the inside of an "ideal" pool room would have the following design elements:

- No materials that are hydroscopic or could react to chlorinated products (304 stainless steel must be used where 316 stainless cannot).
- Moisture migrates based on vapor pressure differently. Moisture will condense on cold surfaces, any surface that is colder then space dew point, typically 62°in a pool room. The ideal situation is to have a vapor barrier on the inside of external walls and roofs. The insulation should be on the side of the vapor barrier facing the exterior. The concept is that the indoor temperature will keep the vapor barrier warm, thus above dew point. A recommended vapor barrier is Alumiseal®. If material is on the inside of the vapor barrier, that material must be acceptable in a high moisture content room. Sealed lights and electrical outlets must be used to ensure that moisture does not get past these holes in the ceiling. A pool room environment, the majority of the year, has more humidity than the outdoors, especially in the wintertime. During winter months, we are concerned of vapor condensing in the cold wall cavities and that is why there is a need for an interior vapor barrier. In the summer, the wall cavity is warm so vapor from the outdoors will not condense. A Tyvek barrier on the exterior will allow the wall to breath water vapor and but keep out water in liquid form.
- Windows should be high quality with a minimum of two-pane glass with at least an overall U-Factor of 0.33, aluminum with thermal break or vinyl wall foam insulation in frame.
- Duct work should be flush to all outside wall surfaces such as windows, with the warm dry air being supplied by the dehumidifier. In the cooling mode, the discharge air temperature should be limited to 62°F.
- Measures should be taken to prevent moisture and chemical vapor from leaving the pool room to the outdoors or to adjoining spaces though the building structure. As for airborne chemicals, the pool room should have negative pressure to the adjoining space. This can be done with an exhaust fan in the pool room and/or pressurization of the adjoining space.

Q4. Is there any special provision required in the walls to separate the pool from the remaining part of the building?

A4. See responses to questions 1, 2 and 3.

Q5. To clarify one of the first slides, is maintaining negative pressure recommended practice?

A5. For a pool facility, maintaining a negative pressure is a must. You do not want to push moist air containing chemical compounds into adjacent spaces. We recommend ASHRAE guidelines of negative pressure between 0.05" and 0.15" WC.

HVAC Equipment and Pool Room Accessories

Q1. Why are pool covers not more commonly used to reduce evaporation when the pool is not being used? Can you also speak about pool covers and their impact to mechanical systems, chemical use, water consumption, health, etc.

A1. The main reason why pool covers are not widely used is that manual pool covers are a

nuisance and eyesore in the view of the pool owner and automatic pool covers cost too much. While they do work very well in reducing evaporation, they do not help to downsize the dehumidifier. Peak evaporation occurs when the cover is off so the dehumidifier must be sized to meet that load when evaporation occurs. On the other hand, a covered pool does reduce the amount of make-up water needed, plus there is a corresponding reduction in additional chemical for the new make-up water. When used during inactive times, pool covers can also reduce the run time of the dehumidifier lowering energy costs.

Q2. Can a pool room be effectively dehumidified with just a heat exchanger without the need of DX cooling especially in the Northeast?

A2. If the customer is looking for 100% control of humidity and temperature in the pool room, then the answer is no. There are times during the year when the outside air is either too humid or too hot to maintain the space conditions. Without conducting an audit of the specific system, the amount of time that the conditions are out of control will be between 15% to 25%.

Q3. What kind of corrosion protection do you recommend for the cooling coils?

A3. We recommend a fully dipped coil coating to protect the fin, tubes, distributor and casing. A well-known coating is ElectroFin®. [This is an epoxy material electrostatically applied that covers all surfaces of the coil. It should be used on all airside coils that are exposed to the airstream.]

Q4. Can you discuss purge techniques? Does an economizer scheme work in a pool room?

A4. First we must separate the two concepts of purge and economizer as they are utilized for completely different purposes. A purge is used after a pool must be shocked to eliminate the release of chloramine byproducts. This can be accomplished by introducing outdoor air into the space, either conditioned or unconditioned. A 100% outdoor air purge is run for 30 to 60 minutes after shock. If the dehumidifier does not have the capacity to either heat up 100% outdoor air to space temperature in the winter, then the pool space conditions can swing wildly. If the dehumidifier is not oversized to accommodate these extreme conditions, then a purge over time is utilized, meaning that you supply a smaller amount of outdoor air for 2 to 4 hours to purge the space. [It should be noted that a properly selected and applied water treatment system, such as U.V., will greatly reduce chemical problems. The correct approach is to address the water chemistry issues directly rather than focusing on increased ventilation.]

An economizer is used to control the space conditions without using the DX compressors. So when the outside conditions are not too hot, too cold or too humid, then the economizer function is allowed to engage. When these restrictions are analyzed, an economizer will operate only 5% to 15% of the year. All other times, the system reverts back to a conventional dehumidifier with code ventilation. You will usually experience an increase in operating cost with an economizer even with 5% to 15% less compressor run time.

Q5. I work with a product called SolarWall® - a ventilation air pre-heating system. If it were possible to pre-heat the ventilation air, would this not benefit the overall IAQ and bottom line? What would be the concerns with respect to moisture levels?

A5. For a pool dehumidifier, code outdoor ventilation air is introduced between the evaporator coil and the hot gas reheat coil. Therefore, this air will not influence the moisture removal capacity of the dehumidifier. Some considerations that must be taken into account with SolarWall® are the added static pressure drop on the code ventilation duct and whether SolarWall® can introduce air that has not been pre-heated during the cooling cycle, otherwise

additional DX tonnage may be required to overcome this passive heating device.

Q6. Which is better, stainless steel or aluminum grilles/ductwork?

A6. 304 stainless steel would be required because 316 SS is not corrosion resistant enough. Since stainless is very expensive, the more popular metal duct is anodized aluminum. It is becoming more common to also see fabric duct in pool facilities because it eliminates all of these corrosion and condensation issues. With fabric duct, however, proper discharge velocities and static pressures need to be accurately calculated to ensure proper blower drives are supplied by the dehumidifier manufacturer.

Q7. In your opinion, what is the best single reference for swimming pool mechanical system design?

A7. The ASHRAE Fundamentals Handbook on dehumidification systems for pool facilities was edited by several industry manufacturers and consulting engineers.

LEED / Energy Efficiency

Q1. I am working on a natatorium that is going LEED silver. What documentation can Desert Aire give for energy usage, efficiencies and recovery that will be acceptable to LEED for proper documentation?

A1. Desert Aire can provide moisture removal capacity (MRC) and moisture removal efficiency (MRE) values as defined by AHRI Standard 910 on indoor pool dehumidifiers. This would provide you with the pounds per hour of moisture per kilowatt energy input. In addition, we can provide you with the amount of energy our systems recover to offset the space heating demand. Finally, units using R-410A refrigerant can also assist you in acquiring related LEED points.

Air / Air Flow / Air Velocity

Q1. Please explain further the idea of "The Bubble?" What is the best velocity to "break the bubble" without increasing the evaporation rate excessively?

A1. When chloramines form in the pool water, they will release into the air until the partial pressures are equal. Since the chloramines gas is heavier than air, it will settle over the pool in the shape of a "bubble." Depending on how the duct distribution system is designed, the air turnover rate of the dehumidifier may not have enough force or movement to push the more concentrated chloramines gas away from the pool. During our webinar, we discussed that a percentage of the air should be directed over the pool to help dislodge or break the bubble. As the question identifies, an improper duct design may introduce more air over the surface of the water than allowed by the basic evaporation rate formula. This can be compensated by changing the velocity factor and accepting a higher evaporation rate to obtain the benefit of pushing the air over the water's surface. There is research being conducted to put more definitive limits on this discussion, but for right now it is our recommendation that the air velocity over water at the edge of a pool not be more than 40 ft/min.

Q2. Does the use of ceiling fans help "break the bubble" with low velocity air that will not overly increase the evaporation rate?

A2. For retrofit applications where the duct work cannot be easily changed, we believe that ceiling fans (assuming not an extra high ceiling) would help break the bubble.

Q3. Would you recommend supply air delivery from floor level, up across windows and then returned high in the ceiling in a Florida indoor pool?

A3. An additional low return is now being recommended to help the airflow break the bubble over the water.

Q4. What fresh air ventilation rates would you recommend in light of the greater air quality issues? Is there any benefit to increasing outside air beyond 0.48 CFM per square foot for a short period of time after shocking a pool?

A4. Research is being conducted to help quantify this question. All evidence today indicates that the current ventilation level is adequate. If a pool requires shocking with chemicals too often, then the use of UV light for chemical treatment will ensure that less outdoor air is required.

Q5. If you select a diffuser to get air down to the pool surface, does this cause more of a discomfort to the swimmer, or is it better to remove the chemical gas build-up?

A5. This cannot be answered until the system is designed. But in general, the swimmer who leaves the pool and is under a diffuser will feel colder than if a diffuser was not there. However, it is our opinion that air quality should supersede comfort of an active participant. A dry swimmer would actually prefer the air movement.

Q6. We generally design our systems for blowing air across the structure and exterior windows. Some people say displacement ventilation is superior. Is there any merit to this?

A6. In a pool room, using low discharge grills can be viewed as advantageous because it helps to sweep the glass windows (warm / hot air rises, so it takes advantage of natural tendencies). Currently, displacement ventilation has been limited to schools or office buildings. It is our opinion at this time that not enough research has been done to comment on the use of displacement ventilation in a pool environment.