Technical Bulletin No. 3-6A

INDOOR SWIMMING POOL ENCLOSURES

EVAPORATION

Evaporation of water from swimming pools, fountains, and industrial applications can have disastrous effects if not properly controlled.

The high moisture increases energy cost to heat the enclosure and, if not controlled, increases maintenance costs for repairs to structural components, and will cause premature failure of equipment used to heat and cool the structure.

Damage is more evident in a swimming pool enclosure, where the moist air is combined with chlorine from the pool chemicals. The chlorine attacks ferrous metals and will accelerate corrosion to a dangerous level. Chlorine will also deteriorate cement blocks, bricks, and mortar joints, as it permeates the walls of a structure.

Humidity greatly affects the comfort of building occupants, making it almost impossible to work or relax. Ideally, the relative humidity should be maintained between 50% and 60%. as suggested by ASHRAE.

High humidity adversely affects indoor air quality by providing the moisture that fungi, viruses, and bacteria requires to breed and grow. Generally, occupants, that suffer from respiratory infections, asthma and allergies will find it especially taxing, and even harmful.

CONTROLLING MOISTURE

Installing a dehumidification system is the most important step in removing the excessive moisture from an indoor pool enclosure.

A properly sized system will automatically maintain the correct relative humidity. If so equipped, a dehumidification system also recovers and recycles energy back to the air space as a by-product of free heat.

Efficient dehumidification will not take place if the air distribution system is not properly designed. If, for example, the supply air is channeled over the water surface, it will accelerate evaporation, as well as causing bather discomfort.

Another serious problem associated with a poorly designed distribution system is uneven air disbursement over cold outside surfaces. This results in condensation on exterior walls and windows that is both unattractive and damaging.

Condensation forms as the warm, moisture filled air comes in contact with cold surfaces, such as outside walls and windows and interior furnishings. When the moisture in the air reaches the dewpoint temperature on a surface, it condenses.

To prevent condensation from forming the surface temperature must be much warmer than the air dewpoint temp.

Controlling Condensation

Since condensation is dictated by temperature and humidity, it makes sense to control both wherever possible.

Properly positioned supply and return ducting controls the majority of condensate problems, but other methods help prevent this problem, especially in new construction.

Glass doors and windows that are exposed to outside air should have the lowest R rating available. Double or triple pane glass panels are best, and they should be insulated or sealed in vinyl-clad frames wherever possible.

Window frames must be sealed to adjacent walls and insulated with non-porous insulating materials. Window and door frames must have thermal breaks.

Higher than normal pool water temperatures will increase evaporation. Maintain the proper water temperature (80°F to 82°F for public pools. Water temperatures for spas/whirlpools are warmer than general activity pools, and require special attention because of their small size and much higher evaporation rates.

A lower room air temperature (when compared to pool water temperature) also increases evaporation. Maintain the space temperature approximately 2°F to 4°F above the pool water. Not only will the evaporation rate decrease, but bather comfort will improve.

Water agitation and splashing, rapidly increases the evaporation. This is evident where large fountains are present. If condensation is difficult to control, it may be necessary to remove or limit fountain activity to a controllable level.

Likewise, wet decks from bathers will accelerate evaporation. Avoid using carpeting or other materials that will retain moisture.

One of the best deterrents to condensate formation is to include a 4 mil vapor barrier in wall and ceiling construction. While this is usually only applicable to new construction, it can have a dramatic effect on the wall or ceiling temperature.

A vapor barrier also prevents moisture migration through the walls and ceiling and from condensing moisture within the wall structure. As the outside temperature decreases, the dewpoint will be reached at a mid-point within the wall.

Moisture migrating through the wall because of no barrier condenses within the wall structure itself, resulting in a loss of structural integrity.

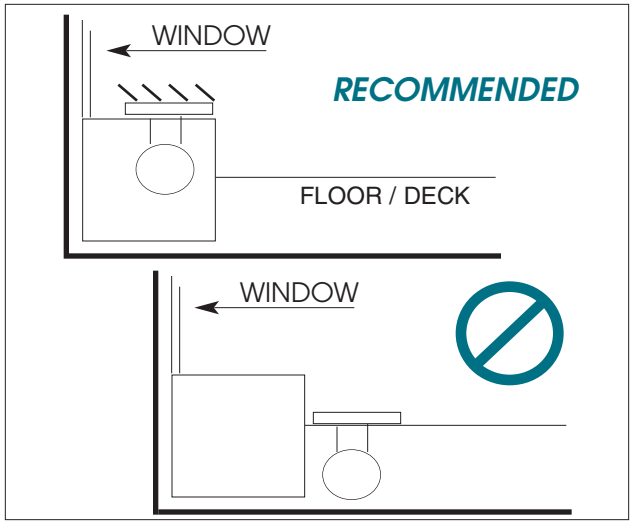
Condensation problems can be avoided with careful evaluation of the swimming pool environment at the design stage. Addressing the issues during construction goes a long way toward maintaining an energy-efficient pool enclosure for many years.

Air Distribution System

Properly installing a good air distribution system inside a swimming pool enclosure or other high moisture environments is critical. Keep in mind the objective is to maximize air flow of warm, dry supply air over the surface that is prone to condensing temperatures. This will include all exterior doors, windows, and skylights.

For optimum results, supply air should be ducted around the perimeter of the structure. For walls and low-set windows

that are colder than the room temperature, a flood of low velocity, warm, dry air should originate from the base.



Ideally, below-grade ducting with linear slot diffusers should be used to distribute air evenly across the surface, to prevent the moist air from reaching the wall or window. As the warm, dry supply air rises, it will pick up moisture and return it to the dehumidification system.

Another important reason for even wall washing is to eliminate cold, dead-air spaces that may form on windows and walls. This cooler air migrates down walls and across the floor, resulting in bather discomfort as it reaches the pool's edge.

In situations where windows are located higher on a wall, ducting around the sophet level may be required. For best, optimum results, the supply air grille must be located close to the window surface, preferable within 12 inches from the glass.

Avoid duct positioning that results in short cycling of the supply air. Short cycling is caused when the location of the return air inlet is too close to, or directly in line with, the supply duct, causing the warm, dry supply air to recycle prematurely.

Airflow should not be directed over the swimming pool water surface or over any water surface in general. In a pool area, the airflow can cause discomfort for bathers as they exit the pool. Airflow over or too near the pool accelerates evaporation and limits the effectiveness of the dehumidification system.

Remember, the greater the velocity, the greater the evaporation process.

Location of the primary return duct plays a critical role in preventing air stagnation and capturing moisture-laden air as it rises to the ceiling. As the warm, dry air rises along walls and windows, it picks up moisture present in the room air, taking it to the highest point in the enclosure.

This moisture-laden air must be returned to the dehumidification unit for moisture removal. The positioning of the return air inlet depends on the locations of the supply ducts and enclosure height.

In most pool area applications, a single return duct is sufficient. The desirable location for the return is at a point high enough to capture the warm, humid air that naturally rises. Normally 8 ft. to 12 ft. above the floor and not to exceed more than 15 ft. above the floor, as the air may be too warm and could result in a reduction in efficiency of the dehumidification process.

Care also should be taken to prevent short cycling of the supply air. This occurs if the return air grille is located in line with or near the supply duct diffusers.

Duct Design

The design goal is to keep all surfaces of the glass at least 5°F above the pool room dewpoint temperature.

For optimum performance, ductwork design and installation must conform to the most recent ASHRAE low-velocity, low-pressure duct standards.

Low velocity is important for good air movement and user comfort. The low velocities are instrumental in reducing noise levels. Standard galvanized sheet metal is recommended for straight runs, and 90 - degree elbows with turning vanes incorporated with acoustic insulation at curves and offsets.

Avoid all restrictions and any short radius elbows that will increase static pressure and cause air turbulence in the system.

It is important to seal all joints, to prevent moisture impregnation into ductwork. Also, insulate all ducting that is located in areas that are unheated or below room temperature to prevent condensation and heat loss or heat gain.

For below-grade ducting, PVC-coated, spiral galvanized steel is recommended. Below-grade ducting also should include a drain or pump to remove any water that may drain from the deck surface.

Skylights pose a special problem for condensation prevention. Skylights, because of their isolated location, are usually farther away from the perimeter supply grilles. While not recommended, they may be positioned strategically above the water in a swimming pool for natural lighting.

To control condensation on skylights, use a supply duct to flood the entire glass with warm, dry air. Condensate drains are highly recommended and should be installed to take away any moisture that does form.

Ceiling Fans

Another method is to install ceiling fans, running in reverse mode, to draw up the warm air against the glass surface. This will prevent drafts and avoid increased pool water evaporation. This method has proven to be effective, but it's not as reliable as direct ducting. Local code may not allow ceiling fans directly over the pool water.

Registers and Grilles

Select hardware resistant to deterioration from the presence of pool chemical in the atmosphere of the space enclosure. Such as anodized aluminum supply and return air registers.

Choose supply register locations carefully making sure that all outside walls and the entire inner surface of exterior glass are blanketed with warm supply air. All lineal diffusers should be within approximately 23 inches from the glass surface. Keep supply air away from the pool or whirlpool water surface. Registers should cover the entire width of each window.

Mechanical Room

Adequate space must be planned in advance for the dehumidifier and duct work.

Service access to the equipment is also important for air filter replacement and annual service checks.

Do not store pool chemicals inside the mechanical room!

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W185 N11497 WHITNEY DRIVE • GERMANTOWN, WISCONSIN 53022 • (262) 250-8500 • FAX: (262) 250-0886 • eMAIL: info@dryaire.com