

Heat Recovery Systems – Achieving Energy Efficient Indoor Pool Design



Indoor Pools need to be well ventilated to ensure a healthy indoor air environment.

The following paper was presented at the 21st IRHACE Conference held in Rotorua May 2011 themed "Heat Recovery Systems – Achieving Energy Efficient Indoor Pool Design". David Gartrell works for Air Change in Australia as the National Sales Manager and has 10 years experience working with designers on indoor pool projects.

Conditioning the air inside a heated indoor pool space is a particularly challenging and energy intensive process in which three major problems must be overcome:

- Heat and water loss
- Indoor Air Quality
- Corrosion

Designers must be aware that most guidelines for indoor pool design do not address all these aspects adequately and they must therefore carefully consider their design and the equipment they select.

HEAT & WATER LOSS

The air temperature inside the space is a critical aspect in pool design. By maintaining it slightly above the water temperature (+1 to 2°C), heat loss from the water to the air can be minimised. It is much more energy efficient to heat air, as opposed to heating water, subsequently designing for this temperature is highly recommended.

Reduced evaporation loss from the pool surface in addition to enhanced comfort levels for swimmers leaving the water further validates the decision to control air temperature.

The air distribution should be directed away from the pool surface to further reduce evaporation and instead should be supplied to effectively wash over any glass surfaces that are exposed to the outside environment.



Ryde Aquatic Centre

Indoor Pools can require up to 8 air changes/hour to reduce airborne impurities and control condensation. With outside air heating using 34kW per 1000 l/s (based on 0°C ambient / 28°C indoor) a small 25m indoor pool could require up to 170kW of airside heating. A high efficiency Heat Recovery System (HRS) can reclaim up to 80% of the heat in the exhaust air and use only 7kW per 1000 l/s.

The HRS can also be used to re-capture evaporated moisture as it condenses in the exhaust air stream. To do this the drain from the HRS must be independent of any systems that would require drainage to waste.

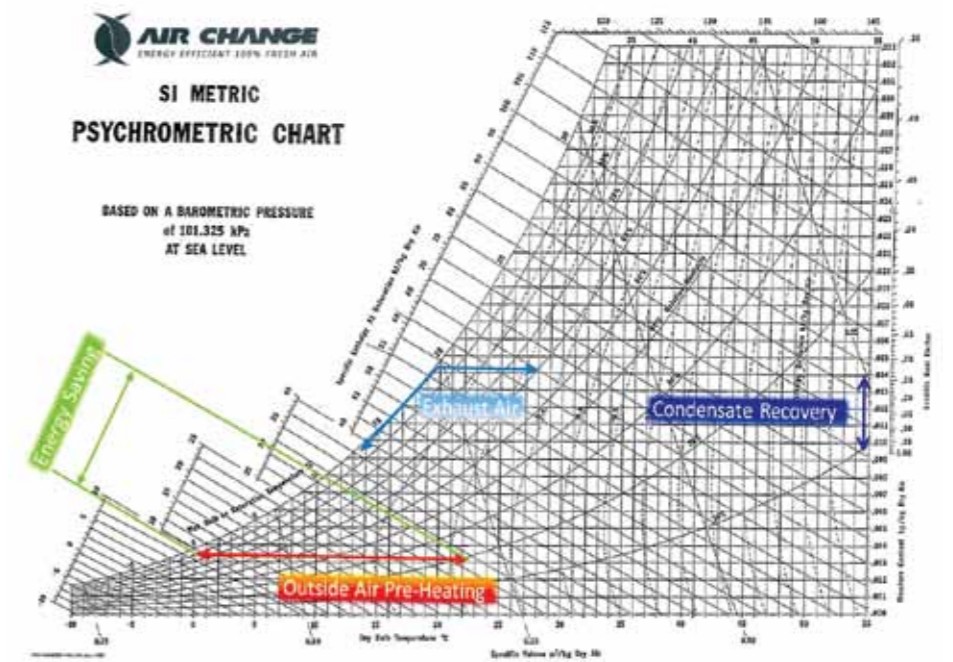
INDOOR AIR QUALITY (IAQ)

Maintaining proper indoor air quality is another major challenge facing designers. Nitrogen trichloride, a readily inhalable toxin, is one of the by-products of pool chlorination. Chloramines are produced by the reaction of bodily proteins and chlorine.

Research has shown this to be a major cause of childhood asthma and can cause lung damage equivalent to regular smoking, as well as skin and eye irritation.

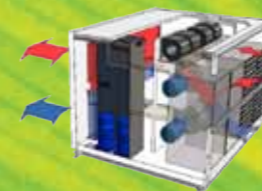
As shock chlorine dosing is generally not an option available to public pools, high ventilation rates are essential for efficient removal of chloramines and other air impurities.

A ventilation system can also assist with maintaining water quality as airborne chloramines will redissolve in the pool unless removed.



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The Air Change PoolPac™ Unit

The indoor pool environment is also ideal for the growth of mould and mildew.

Indoor pool operators should mitigate potential Occupational Health and Safety (OH&S) risks by maintaining acceptable IAQ. Staff exposed to the atmosphere for prolonged periods may suffer health effects as identified in numerous studies.

Effects on the lung occur when nitrogen trichloride in the air exceeds a concentration of 300 mg/m³

"Our results show, indeed, that nitrogen trichloride (produced by Chlorine) is a cause of occupational asthma in indoor swimming pool workers like lifeguards and swim instructors,"

Dr. K. Thickett of the Occupational Lung Diseases Unit at the Birmingham Heartlands Hospital.

The high efficiency HRS provides a high ventilation rate of warm, dry outside air to the pool hall while minimising energy usage and reducing water loss through evaporation.

CORROSION

In 1985, twelve people were killed in Uster, Switzerland, when the concrete roof of a swimming pool collapsed after only thirteen years of use. The roof was supported by stainless steel rods in tension, which failed due to stress corrosion cracking.

The atmosphere of indoor swimming pools is one of the most aggressive in the building industry. As condensation evaporates, chloramines concentrate and become corrosive. The corrosive

effects can cause major damage to plant equipment, the building structure, brackets for suspended light fittings and loudspeakers, pipework, conduits, rod/bar supports for ventilation ducts, water slides and other design features, wire rope supports for water slides and also fasteners.

The key to minimising this type of damage, providing a safe indoor environment and reducing heat loss from the water is to maintain a sufficiently high quantity of warm, dry air circulating throughout the pool hall and in particular those areas that come in to contact with the cold outdoor environment. Recirculation of pool air can increase humidity, as well as adding to the build up of contaminants in the atmosphere. Regular washing, maintenance and inspection is also required.

Although it is contradictory to most design principles an indoor pool hall should maintain a slight negative pressure to prevent condensation in the seams of the building and to contain the corrosive atmosphere. Obviously an effective rate would be dependant on the buildings seal.

Corrosion can be effectively controlled by a combination of good design, careful selection of exposed components and effective management, including maintenance and inspection.

Air Change has worked with indoor pool designers, engineers and specifiers to combat the harsh effects an indoor pool environment often produces. The PoolPac™ has been designed specifically for indoor pools and includes features to overcome issues of corrosion, poor air quality and heat/water loss. ■

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