



Heat Exchangers



# Diving into green HVAC

Swimming and recreation centres are a valuable community resource. They are also large users of water and energy. CCN investigates how Air Change is helping save these precious resources.

## Energy issues faced by aquatic centres

Major energy is used for pool water heating and pumping. However, when the pool is in a building, a lot of energy is also required to heat, dehumidify, and circulate the air. The internal air needs to be renewed with around eight to 10 air changes per hour of outside air to dilute the corrosive atmosphere and reduce harmful condensation which attacks the building's structure.

The air inside must be kept at a comfortable warm temperature at within 3°C above that of

the water to limit moisture and heat loss from the pool to the air, further increasing the energy cost of heating and cooling the building.

Many pools control humidity by bringing in dry cold air and removing the moist warm air from the pool building.

This is very wasteful, as the incoming air must be heated and the heat in the exhaust air is usually lost.

The design of many aquatic centres with large areas of glass further adds to running costs. The other significant energy users are air conditioning of 'dry areas' such as gymnasiums and aerobics rooms, creche, cafe and function rooms.

## Indoor Air Quality (IAQ) issues

People working and using the facilities need outside air ventilation for indoor environment quality.

Health problems of swimmers in indoor pools have traditionally been attributed to the chlorine in the water. Chlorine reacts with bodily proteins to form chloramines and the most volatile and prevalent in the air above swimming pools is nitrogen trichloride. Swimming pool asthma due to airborne nitrogen trichloride can occur in swimmers and even workers who do not enter the water. 1

**MAIN:** Some of the attractions of Ryde Aquatic Leisure Centre include the full Olympic pool to the right, with the family-friendly facilities of warm water pool, wave and whirl pools to the left. Rigid ducting for 100 per cent fresh air distribution can be seen at the perimeters.



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### Water conservation concerns

Water conservation is made more difficult in aquatic centres as pool water is evaporated off the surface and exhausted out of the building due to the large quantities of outside air needed to ventilate and dilute the internal atmosphere. Huge amounts of clean, and potentially reusable, shower water is used by swimmers and lost to the building.

### Ryde Aquatic refurb opportunity

An opportunity to resolve some of the energy and water issues was made available to the Ryde City Council on its major mechanical equipment refit of the Ryde Aquatic Leisure Centre, the venue for water polo at the Sydney 2000 Olympic Games. The centre offers a huge range of facilities, including a 50m indoor Olympic pool, a 25m indoor pool, a warm water program pool, 40m wave pool, 56m water slide, bubble whirl pools, rapid river and a children's wading pool, along with an indoor climate controlled sports stadium, steam room, sauna and café.

### Air Change PoolPac equipment

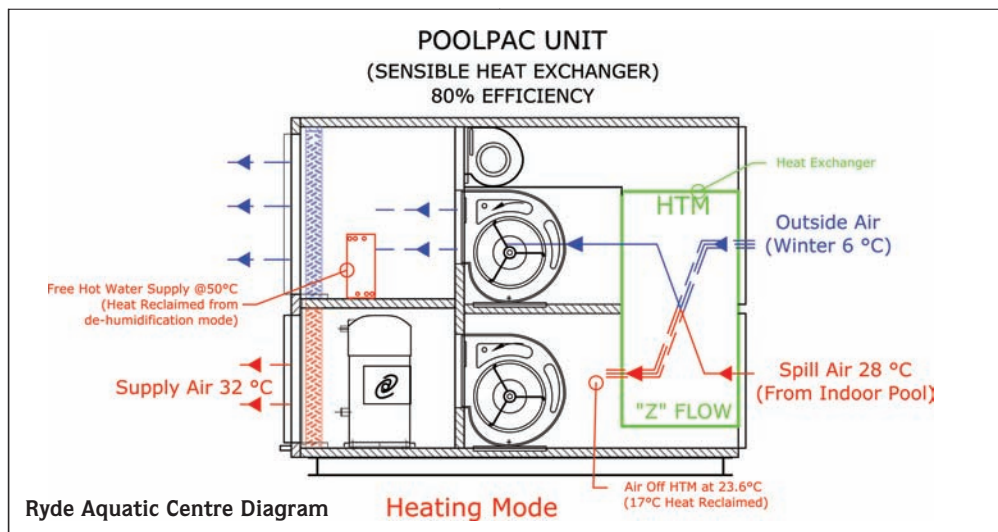
The consideration of equipment covered issues of energy efficiency, IAQ, removal of condensation, corrosion resistance of the units and the ability to conserve water and provide free water heating.

The energy efficiency of the Air Change PoolPac units over standard air conditioning units is due to the patented inbuilt heat recovery system to cost-effectively supply 100 per cent outside air ventilation and air conditioning which indoor pools require.

For every 1000 litres per second of outside air (at Sydney winter conditions), the Air Change heat recovery system will save 22kW of air conditioning plant size. This equates to approximately 440kW of free heating for a standard 50m eight-lane pool.

### Schematic Heating mode

The incoming outside air is pre-heated by the energy reclaimed from the exhausting corrosive warm air. Both air streams pass through the heat exchanger in separate paths, transferring temperature through the non-corrosive walls of the heat exchanger, without any air mixing. Therefore, the heat in the exhaust air is not lost as it pre-heats the incoming air, normally a wasteful process for conventional air conditioners which do not have inbuilt heat reclaim. The manufacturer claims an 8°C per cent transfer of sensible heat between the return air path and the outside air. The units are constructed of 50mm Colorbond Sandwich panel for best practice insulation, with purpose-built UV treated plastic joiners to reduce heat loss through the body of the unit. For greater energy efficiency, all Air Change three-phase units come standard with VSD's to control fan speeds, with fans and motors direct coupled, negating the need for troublesome belts and pulleys.



Ryde Aquatic Centre Diagram

Heating Mode

### Improvements in IAQ

IAQ is assured with the high levels of outdoor air to recycle the valuable heat but expel the chloramines so harmful to health and other air impurities. The Air Change units, with 100 per cent outside air, avoid the problem of recirculation of pool air, which is not recommended where there is a chloramine problem as volatile disinfection by products can build up and may cause health problems.

### Removal of condensation

One hundred per cent outside air is also the key to removing condensation and the structure damaging corrosion it causes to pool complexes. The installation at Ryde Aquatic Leisure Centre occurred in December 2006, however the centre should notice a marked reduction this winter in condensation on areas of glass and moisture on the structure of the building.

### Corrosion resistance

The Ryde Aquatic Leisure Centre had an earlier Air Change unit installed at the pool and it had weathered the corrosive conditions extremely well over the period. Corrosion resistance treatment to the cabinet, fans, coils and any part in contact with corrosive air is crucial to the long life of the units in the corrosive atmosphere of indoor pools. The air-to-air heat exchanger is also completely non-corrosive with mylar heat exchanger plates and chromated and powdercoated aluminium casing.

### Water conservation

Australia is suffering its highest levels of water stress in its history. The Air Change PoolPac 100 per cent outdoor air packaged units have been designed with hot water de-superheaters, not only to heat and ventilate the pool all year round but also to use waste heat from the compressor to provide free hot water for pool heating and showers. Further, the sensible heat exchanger condenses the exhaust air moisture which can be used to replenish the evaporation lost in the pool.



Four split construction, sandwich Air Change PoolPac units, with generous access doors on two sides, fit neatly into the existing plant room.

### Details of the installation

The installation had some issues with access, as the four new units were a retrofit and the spacious plant room had a very narrow access area through some double doors. Air Change had to re-engineer the PoolPac units considerably, requiring a reduction of height and a split construction of the unit.

### Other Air Change projects

Aquatic centres require specialist designers who can demonstrate a record of energy efficient design due to the extremely complex requirements and potentially very high-energy use.

- The Australian Institute of Sport, Canberra (Consultants: Acor, Installation: Climatch Group)
- Springwood Aquatic and Fitness Centre (Consultants: Paul Stevenson and Associates; Installation: Crest Air Conditioning; Client: Blue Mountains City Council)
- Blacktown Leisure Centre Stanhope (Consultants: Paul Stevenson and Associates; Installation: Crest Air Conditioning; Client: Blacktown City Council)

1 (Thickett, McCoach, Gerber, Sadhra and Burge)

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