

# Indoor Pool Climate Control

## Controlling the Indoor Pool Environment

A well planned indoor pool hall must have the appropriate climate control method to provide comfortable conditions for swimmers and spectators and to protect the building.

There will be a number of decisions taken in the design process and the client should be part of these decisions to ensure that the scheme lives up to their expectations and their fundamental demands. In this way any shortfall from expectations cannot become an issue after the project is completed.

It is important to include consideration for a climate control system during the initial building design stage, especially with regard to plant layout and the buildings' architectural suitability for the proposed purpose.

Key considerations should be;

- Adequate plant room space
- Access for duct work to reach areas of potential cold bridging such as windows and doors as well as providing good overall recirculation within the building. It is important to realise that during cold weather unless a ducted system is used and correctly designed, condensation is likely to form on surfaces such as window and door glass
- Cold bridging is minimised by the use of good quality window and door glazing and frames
- Cold roof spaces need to be completely sealed from the pool hall

The indoor pool climate control system can provide many different functions but some clients choose to omit some features. This is sometimes due to budgetary constraints and occasionally due to aesthetic issues. It should not be due to ignorance however and the system designer and contractor should work with the client to ensure that this is not the case.

Some of these decisions may result in cheaper initial outlay, but higher year on year running costs. Some more expensive systems will pay back the outlay with reduced running costs.

The functions available may include:

- Air heating
- Water heating
- Heat recovery to air
- Heat recovery to water
- Fresh air introduction
- Stale air exhaust
- Room pressure control
- Dehumidification  
(The reduction in pool room relative humidity)
- Air circulation, either basic or comprehensive, normally requiring air ducting
- Air cooling



Just as the potential functions are numerous, so are the types of machines which can perform these functions and this factsheet will work through the most common methods that have been used. As with most engineering subjects, new technologies and changing fuel costs will mean that this list will be added to, and that systems that are not as popular now may in the future become more common. The system designer therefore has a responsibility to keep abreast of the changes relevant to the subject.

The fundamental requirement of all schemes is to attempt to make the pool room comfortable to both swimmers and any spectators and to protect the building. This will normally require heating of the room air, introduction of fresh air and control of the room relative humidity. Raising the room temperature will provide comfort for the occupants and make the air more capable of holding moisture. Raising the air temperature above pool water temperature also tends to reduce the amount of heat lost from the pool as well as reducing the evaporation of pool water into the air.

Humidity control is essential and not only will this make the room more comfortable, but will also serve to reduce the risk of condensation on the building fabric.



The condensation that is found in homes and workplaces is formed by exactly the same process that takes place in indoor pools, where evaporated water that is trapped in the air comes into contact with a colder surface. In extreme conditions, the condensation can be accompanied by a mist forming in the pool hall. Controlling the build-up of water vapour (normally expressed as relative humidity) is vital if the pool hall fabric is to be protected and the environment within the hall is to offer a comfortable and relaxing leisure space. There are a number of steps which can be taken to overcome the problems associated with condensation.

### Temperature control

The air temperature is normally controlled at around 1°C warmer than the water temperature. This is to reduce evaporation and to improve the comfort for swimmers as they leave the water. However, this raised temperature is not normally necessary when the pool is covered and the pool is “unoccupied”. Therefore, most systems will operate with a second temperature control, normally called a “set back” temperature.

The set back condition is normally between 23°C and 24°C and allows a significant amount of energy to be saved by not heating the air to the “occupied” condition when a cover is used.

### Condensation control

Condensation will form on surfaces that are colder than the room air dew point temperature. The dew point of air is the temperature at which water vapour will fall out of the air as moisture.

As an example, if the pool hall air is 30°C and 60% relative humidity, condensation will occur on any surfaces that are colder than approximately

22°C; A lower pool room air relative humidity will decrease the likelihood of condensation forming on surfaces and a higher air relative humidity will increase the likelihood of condensation.

In the case of a swimming pool hall, condensation is most likely to occur on windows, window and door reveals and other areas of the construction where a cold bridge to the outside exists. High quality glazing and frames will reduce the risk of condensation forming on windows and careful consideration to cold bridging by good design and

building practise should be observed. To further decrease the possibility of condensation forming, it is common practise to distribute warm air across windows and other vulnerable areas of the room via an air distribution system. This increases their surface temperature and therefore reduces the risk of condensation occurring.

It is also critical to ensure that pool hall air cannot enter cold roof spaces, (or other unheated voids) as water vapour will build up in these areas and eventually condense, forming unwanted condensation in the roof structure and roof insulation. To prevent this, it is important to ensure that a vapour control layer is fitted between the pool hall and roof space and that adequate ventilation of the roof space is provided.

The dehumidification system can only attempt to control surface condensation in the pool room. Any condensation in the roof space or within the building walls is known as interstitial condensation and can only be prevented by correct building design and construction.

### Humidity control

To help prevent condensation, protect the room fabric and provide a comfortable atmosphere for users of a swimming pool hall, the pool hall humidity must be carefully controlled. For this to be achieved, the maximum humidity levels within a pool hall should be between 55% and 65%.

A swimming pool hall will require a form of moisture extraction to control relative humidity by removing unwanted water vapour from the hall air. To deal with this a number of different technologies are available. In the UK, two different methods of moisture extraction are most commonly used;





## Fresh air with heat recovery

A fresh air system will simultaneously extract stale air whilst introducing outside air to and from the swimming pool hall. In so doing, unwanted humidity will be swept from the building. Early versions of these schemes were simply this and had very high energy demands due to the large quantity of warm air simply discharged to atmosphere.

To reduce the ventilation heat losses that this process creates, modern systems use the discharged warm air to preheat incoming outside air by passing both the airflows through a heat exchanger. In this way up to 70% of the exhaust air temperature (sensible energy) can be recovered into the incoming fresh air but very little of the moisture energy (latent energy) can be recovered unless the incoming air is very cold.

The most popular form of heat exchanger used in these schemes is a recuperator. This is a fixed bank of thin plates with stale and fresh air running through alternate airways. Other types of heat exchanger are available and it could also take the form of a thermal wheel or even what is known as “run around coils and heat pipes”.

When pool hall relative humidity levels are correct the system will normally revert to recirculating the air, rather than rejecting it to outside. More basic schemes often have a fixed volume of fresh and stale air with no ability to recirculate the room air if appropriate, and these can generate unnecessarily dry conditions in the winter as well as consuming far more energy than necessary.

It would be normal for these systems to be provided with an air and water heating system and connected to an air distribution system. In this way, the system will provide humidity, water and air temperature control, as well as the ability to distribute air evenly around the swimming pool hall.

A variation on the fresh air system is the direct gas fired unit. These operate by bringing in large volumes of fresh air and driving it over a gas burner. The humid pool air is extracted and often discharged to waste. Some systems have the ability to recover heat between the exhaust and the air intake. Unfortunately with these systems even if the humidity is only slightly high, large fresh air volumes are required to supply the gas burner with sufficient air.

As a general rule, it is a good idea to ensure that the system can vary the fresh air input according to the needs of the pool hall, and not simply as a function of the combustion requirements of the gas burner.

## Heat pump dehumidifiers

A heat pump dehumidifier is a device that physically removes water vapour from the pool hall air, rather than rejecting it to outside. The energy that is contained within the air as water vapour can be recycled to provide useable heat for both air and water heating. This process effectively makes the system approx. 250% efficient as very little input (paid for) energy is used to recover the large amounts of latent energy that are present in swimming pool hall air. The process is controlled by measurement of the pool hall relative humidity.

Heat pump dehumidifiers will generally mix a quantity of outside air with the pool hall air that they treat in order to dilute the build-up of air borne chemicals within the pool hall air. Some systems can also provide a degree of summer time cooling by reversing the heat recovery process.

### Heat pump dehumidifiers can;

- A** Be a standalone device that both sit on the wall or floor and control humidity levels by treating hall air that is passed through them via an internal fan. Often these devices are also fitted with an additional air heater that can provide supplementary air heating and/or a mixture of outside air.
- B** Be incorporated into a central distribution system that provides a more even distribution of air around the pool hall, including areas of high cold bridging such as windows. These systems will, generally, also provide water and air heating as a by-product of the dehumidification process and provide summertime cooling by reversing their heat recovery process. A supplementary water and air heating system is usually required by these machines to make up heat that cannot be recovered from the dehumidification process. In this way the system, like a fresh air unit, will provide humidity, water and air temperature control, as well as the ability to distribute air evenly around the swimming pool hall.

## Talk to the professionals

Now that you have a little more knowledge about the climate control requirements of an indoor pool, please make sure that you discuss your plans with a SPATA Member to ensure your requirements are met.

