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Pool hall switches: environmental control in pool halls and wet areas

Continuing the series of articles authored on behalf of SPATA, Richard Carrington and John Scott consider the main requirements for environmental control in swimming pools.

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. This will help reduce the number of complaints from disgruntled visitors and should free more of your time to deal with other matters.

Your role as client should begin at the design stage to ensure that the scheme lives up to your expectations and fundamental demands. In this way any shortfall from your expectations cannot become an issue after the project is completed. It is important to include consideration of the type of climate control system during the initial building design stage, especially with regard to plant layout and the building's architectural suitability for the proposed purpose.

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Key considerations should include adequate plant room space and access for duct work to reach areas of potential cold bridging, such as window and doors, as well as to provide 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 should 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. Sometimes this is due to budgetary constraints and occasionally aesthetic issues. However, it should not be due to ignorance and the system designer and contractor should work with you as 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
- 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 that can perform these functions. Here we will work through the most common

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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 for both spectators and swimmers, and to protect the building. This will normally require heating of the room, introduction of fresh air and control of the room 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 water temperature also tends to reduce the amount of heat lost from the pool, as well as reducing the evaporation of water into the air.

Humidity control is essential. Not only will this make the room more comfortable but it will also serve to reduce the risk of condensation on and within the building fabric. The condensation that is found in workplaces (and homes) 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 that can be taken to overcome the problems associated with condensation.

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 air as moisture. As an example, if the pool hall air is 30Cand 60% relative humidity, condensation will occur on any surfaces that are colder than approximately 22C. A lower pool room air humidity will decrease the likelihood of condensation forming on surfaces and a higher air 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 of cold bridging by good design and build practice should be observed. To further decrease the possibility of condensation forming, it is common practice 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 dew point 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 on 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 this 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, the pool hall humidity must be carefully controlled. For this to be achieved maximum humidity levels within a pool hall should be between 55% and 65%.

Humidity that is caused by water evaporating from the swimming pool can be reduced by maintaining the hall air temperature 1C above the swimming pool water temperature during times when the swimming pool is used, and by using a floating pool cover during unoccupied periods. These steps will not only reduce the effect of humidity in the hall but also reduce the swimming pool water heat losses and the system running costs.

A swimming pool hall will require a form of moisture extraction to control humidity by removing unwanted water vapour from the hall air. To deal with this a number of different technologies are available and in the UK two methods of

moisture extraction are most commonly used;

Fresh air with heat recovery

A fresh air system will simultaneously extract air from and introduce outside air to the 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 because of the large quantity of warm air discharged to the atmosphere. To reduce the ventilation heat losses that this process creates, modern systems use the outgoing warm air to preheat incoming outside air by passing both the airflows through a heat exchanger. In this way up to 70% of the outgoing 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; exchangers can also take the form of a thermal wheel or even what is known as 'run around' coils and heat pipes.

When pool hall humidity levels are correct the system will normally revert to recirculating the air rather than rejecting it to outside and introducing unnecessary fresh air, which would waste warm exhaust air. 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.

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 and that water vapour can be recycled to provide useable heat for both air and water heating. This process effectively makes the system approximately 250% more 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 airborne chemicals within the pool hall air. Some systems can also provide a degree of summertime cooling by reversing the heat recovery process.

Heat pump dehumidifiers can be standalone devices that 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. Heat pump dehumidifiers can also 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.

Finally, talk to the professionals

Make sure that you discuss the climate control plans with your preferred pool contractor to ensure your requirements are met.

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