Ventilation and heat recovery for large public swimming pool halls

A CIBSE accredited CPD seminar
BBC2 Restoration
Series winner 2003

Victoria Baths
Manchester
What are the design requirements for the ventilation system in a modern public pool hall?
Managing health and safety in swimming pools
What are the design recommendations for pool hall ventilation from these documents?

Ventilation rate 10l/s per m² pool and wetted area

Air circulation rate 4-6 per hour (Sport England 8-10 per hour!)

Minimum 30% outside air

Pool hall temperature min 10°C > pool water temperature

Pool hall humidity 50 – 70% rh
New Swimming Pool Hall Ventilation Systems

Maximum Specific Fan Power (SFP) according to Table 36/37 of the 2010 Non-Domestic Compliance Guide

<table>
<thead>
<tr>
<th>Description</th>
<th>SFP (W l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Mechanical Ventilation including heating only</td>
<td>1.6</td>
</tr>
<tr>
<td>Allowance for heat recovery</td>
<td>0.3</td>
</tr>
<tr>
<td>Allowance for return air filter</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Maximum allowable SFP</strong></td>
<td><strong>2.0</strong></td>
</tr>
</tbody>
</table>
# Existing Swimming Pool Hall Ventilation Systems

Maximum Specific Fan Power (SFP) according to Table 37/39 of the 2010 Non-Domestic Compliance Guide

<table>
<thead>
<tr>
<th>Description</th>
<th>Power (W l/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central Mechanical Ventilation including heating only</td>
<td>1.8</td>
</tr>
<tr>
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<td>0.3</td>
</tr>
<tr>
<td>Allowance for return air filter</td>
<td>0.1</td>
</tr>
<tr>
<td><strong>Maximum allowable SFP</strong></td>
<td><strong>2.2</strong></td>
</tr>
</tbody>
</table>
Guidelines for public pool hall design air volumes

1. No more than necessary otherwise the evaporation rate may increase and fan power will be higher than necessary.
2. The hall should be under a slight negative pressure when the pool hall is in use (a few % only)
3. Calculate using the 10l/s rule of thumb guidance in CIBSE B2 will not give the optimum outcome in terms of temperature and humidity control in all cases
4. Calculate the evaporation rate and required outside air volume for dehumidification.
5. Calculate the transmission heat loss and the required air volume for heat transport.
6. Calculated the air volume required for good air distribution. With an induction floor slot diffuser system the air circulation rate is likely to be in the range 4-6 per hour.
7. Work with the lowest air volume that meets all of the calculated values in 4,5&6
Different design criteria apply when:

- The pool hall transmission and infiltration heat losses are very high
- Large numbers of spectators are present
- Large water attractions are present in the pool hall
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Victoria Baths
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What were the first responses to rising energy costs in Europe in the 1970s?

• To implement recirculation of pool hall air
• To introduce heat recovery devices
How successful were these efforts to reduce energy consumption? What was the experience?

1. Unexpected health issues
2. Increased corrosion and deterioration of the pool hall fabric
3. HVAC equipment subject to corrosion, high maintenance costs and short operating life
4. Predicted energy savings not achieved
Single Fan Unit for Large Pools

The PoolPak Single Fan series is a total environmental control system made to remove unwanted moisture in wide-ranging pool enclosures such as natatoriums and athletic centers. It offers the same performance features as the dual fan series except for the economizer and smart economizer energy saving feature.
Outside air ventilation units with heat recovery
- typical heat recovery (temperature) efficiencies

- 35% Run around coil
- 48% heat pipe
- 55% single plate heat exchanger
- >95% Menerga Pool unit
- Assuming pool hall @ 30 oC 60% rh / outdoors -5 oC 100% rh
East Ham Leisure Centre  2 x 343201
Optimum air distribution in swimming pool halls
The air distribution question?

1. Traditional duct/grille underfloor systems are difficult to install and balance
2. Safety issues regarding sharp edges and opening sizes
3. Traditional rectangular grilles are unsightly, especially when large tiles are preferred
No supply air – convection only
Or ineffective high level supply

30°C
55%

28°C
60%

25°C
75%

19°C
100%

dew point: 21°C
t_{\text{window}} = 17°C
Dry supply air blown directly onto window surface with air velocity approx 2 m/s

Higher than necessary transmission losses
Condensation at low level!
Dry supply air parallel to window surface -
Supply air grille with upright blades
air velocity approx. 2 m/s
Dry supply air parallel to window surface - Menerga slot diffusers
air velocity approx 4 m/s

Menerga slot diffusers reduce:
- transmission heat loss by approx 20%
- Fan motor power consumption by more than 25%

dew point: 13°C
t_{\text{window}} = 31°C
Menerga 4 x 8mm pool hall supply air slot diffuser
Waste water heat recovery
HEAT RECOVERY FROM WASTE WATER

- 28°C
- 32°C
- 25°C
- 13°C
- 8°C
- 10°C
- 90°C
- 70°C

Temperature annotations and flow diagram of heat recovery from waste water.
Guidelines for pool hall design air volumes

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Targets for pool hall air quality:

1. Strive for pool water dilution rates of 30 litres per bather
2. Minimise tri-chloramines by maintaining pool water pH in the range 7.2-7.4
3. Separate outside air inlet and exhaust air outlet by minimum 10m according to EN13053 or by positioning on different facades.
4. Avoid low level outside air intakes adjacent to roads and car parks.
5. Avoid short circuiting of air from supply to return air grilles in the pool hall.
Targets for pool hall ventilation system energy consumption

1. Optimise pool hall air distribution using induction diffusers to minimise air volume
2. Strive for maximum possible air tightness and pressure test during commissioning.
3. Pool hall unit specific fan power < 1.8W l/s at 300Pa external
4. Pool hall unit motor efficiency to IE3 standards or equivalent
5. Pool hall unit temperature efficiency under winter design conditions > 95%
Advantages

1. Proven continuity of operation and durability in the aggressive pool hall environment.
2. Proven control system that is able to maintain the optimum pool hall environment with minimum energy consumption under all operating conditions.
3. 98% temperature efficiency under winter design conditions.
4. Better air quality because there is no energy penalty for introducing outside air.
5. Low energy, low maintenance solVent direct coupled fan technology with programmable air volumes achieving SFP<1.8W per l/s.
6. Pool hall pressure control under all operating cycles.
7. Evaporation rate (kg/h) monitored in real time.
8. No pre-heating of outside air required down to -15oC.
9. Menerga units are factory assembled and tested under an EN ISO9001-2008 Quality Assurance scheme.
10. Lowest life cycle costs.
Other CIBSE recognised CPD seminars available from Menerga:

Air conditioning with indirect adiabatic cooling

Large scale Passivhaus ventilation and heat recovery
Thank you for your attention.
MENERGA presents

with 2-stage Heat Recovery
and "adiabatic" cooling

Type: ADSOLAIR
Free Cooling
Adiabatic + integral DX cooling