Indoor Swimming Pools: 
*The Good, the Bad and the Ugly*

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Introduction

• Agenda

• My Experience with Indoor Swimming Pools
  • Design and install Heat Pumps: First Job in Southampton, UK
  • NZ: Energy Audits. Project for EECA- Blackmount High School Solar Heating
  • Australia:
    • Replacing Obsolete Plant
    • Performing Cost Benefit Analysis
    • NSW OEH Service Provider
    • Solving Issues with Condensation- Corrosion, Mould, Rot, Poor Visibility, Electrics!
    • New Builds- Splash Park and Council Pool Major Renovation
Background

• **What will not be covered in the presentation**
  • Water Filtration
  • Disinfection
  • Compliance with Water Quality Regulations

• **What will be covered in the presentation**
  • Heating Pool Water
  • Heating and Ventilating the Pool Enclosure
  • Reasons to Design Correctly
  • Benefits from Operating Efficiently
  • Technology Available
Building Code of Australia - Requirements

• What Does the BCA Say About Moisture Control in Indoor Pools - 
  *Nothing Mandatory.* Condensation in Buildings

• BCA Section J (Energy Efficiency) Requirements
  • Pool Heating:
    • Solar heater (no electric).
    • Reclaimed heating
    • Gas fired heating
    • Heat pump
    • Combination of above
  • Must have cover (if heated pool is in a non conditioned space or spa)
  • Must have time switch (to control heaters and pump (in spa))

• Surprise! Pool shell need not be insulated!
Building Code of Australia Requirements (contd)

• Energy Efficiency: Section J compliance for pool hall through-
  • DtS Requirements: Thermal Insulation, Glazing Calculator, Lighting Efficiency
  • Or, JV3 Model: Protocol for Building Energy Software, JV3 Energy Efficiency handbook

• Ventilation Requirements: AS 1668.2 2012
  • Doesn’t cover condensation control!
  • Requires 10L/s.m² of pool area (115% of pool area)
  • Requires 15L/s.m² of spa area

• So what requirements cover condensation control?
  • WHS? Contractual Requirements?
The Design Process

• Check BCA Section J Compliance- DtS or JV3 model
• Pool cover to be installed or not?
• Establish design pool water temperature, air temperature and RH
• Establish pool water heating requirements
• Calculate pool evaporation loss- ASHRAE Handbook 2015 Section 6 Natatoriums Load Estimation Equations
• Calculate outside air requirements for ventilation from AS 1668.2.
• Check whether outside air will remove winter moisture load, if not increase
• Calculate winter heating load
• Calculate air change rate required to supply winter heating load without excessive supply air temperature, to avoid stratification
• Specify equipment suitable for high humidity chlorinated atmosphere- Galvanised steel, stainless steel fasteners, coated coils, heat exchangers- Ti, Cu/Ni, SS 316, electronic components!
Air Distribution - Underfloor
Air Distribution - High Level Downflow

Pool Hall

Pool
Air Distribution - High Level Bi-Directional
Air Distribution - High Level Single Duct Bi-Directional
Air Distribution- High Level Single Duct Bi-Directional
Air Distribution - High Level Downflow Over-Pool
Typical Design Conditions

- Local Extract from Spa Area
- RH = 60-70% (80%)
- Negative Pressure relative to atmosphere and other areas.

Temperature
- Spa: 34°C
- Pool: 26-28°C
Condensation occurs inside the cavity, causes fabric to Rot!

Cold outside 0°C, 90% RH Winter

Warm inside 28°C, 60% RH

Where temperature and dewpoint lines meet, condensation occurs

outer skin, cavity, insulation, inner skin and vapour barrier.

Condensation occurs inside the cavity, causes fabric to Rot!
Avoiding Condensation!

Pool Hall
Maintain negative pressure relative to atmosphere and other areas.

Admin

Changing Rooms
Technology: Heat Pump

Heat Pump System Components:
- Condenser
- Expansion Valve
- Evaporator
- Hot Gas
- Warm Gas
- Cool Liquid
- Heat
- Outside Air
- Heated Pool Water Out
- Pool Water In

Flow Path:
1. Pool Water In
2. Condenser (Heat Transfer)
3. Expansion Valve
4. Evaporator (Heat Absorption)
5. Warm Gas
6. Outside Air
7. Cool Liquid
8. Heated Pool Water Out
Technology: Condensing Boiler

Hot Water to Pool
Gas
Condensed Water to Drain
Air
Flue Gasses
Cold Water From Pool
Technology: Air-to-Air Heat Exchanger

- Outside Air
- Discharge Air
- Extract Air From Pool Hall
- Supply Air to Pool Hall
Technology: Run-Around Coil
Technology: Rotary Heat Exchanger

Supply Air to Pool Hall

Extract Air From Pool Hall

Outside Air

Discharge Air
Technology: Underfloor Hydronic Heating
Any questions?

Thank you!

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