AIRAH
Information Session

Presented April 2015 by Roy McDougall

Water Treatment Considerations

- Why Treat Water in A/C Systems?
  - Corrosion
  - Anodic/Cathodic protection
  - Closed circuits
  - Chilled Beams
  - Aluminium heat exchangers

Water Treatment Considerations

- Why Treat Water in A/C Systems?
  - Dosing equipment
  - Filtration
  - Commissioning
  - Dead legs
  - Access

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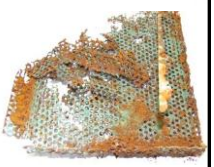
When things go wrong…

…horribly wrong… After only six months

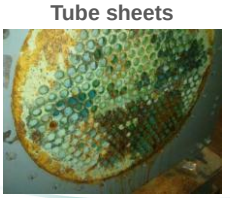
- This was a BAC cooling tower strainer



- Condenser water - failed chiller

Under side of fill

Tube sheets



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Why Treat Water in A/C Systems?

Water needs to be chemically treated to protect against:

- Corrosion
- Scale
- Deposition
- Microbial Growth e.g. bacteria (including Legionella), algae, protozoa, fungi






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GALVANIC SERIES OF SOME COMMERCIAL METALS & ALLOYS IN SEAWATER

Noble or Cathodic ↑

- Platinum Gold
- Graphite
- Titanium
- Silver
- Chlorimet 3 (62 Ni, 18 Cr, 18 Mo)
- Hastelloy C (62 Ni, 17 Cr, 15 Mo)
- 18-8 Mo Stainless Steel (passive)
- 18-8 Stainless Steel (passive)
- Chromium Stainless Steel 11-30% Cr (passive)
- Inconel (passive) (80 Ni, 13 Cr, 7 Fe)
- Nickel (passive)
- Silver Solder
- Monel (70 Ni, 30 Cu)
- Cupronickels (60-90 Cu, 40-10 Ni)
- Bronzes (Cu-Sn)
- Copper
- Brasses (Cu-Zn)
- Chlorimet 2 (66 Ni, 32 Mo, 1 Fe)
- Hastelloy B (60 Ni, 30 Mo, 6 Fe, 1 Mn)
- Inconel (active)
- Nickel (active)
- Tin
- Lead
- Lead-Tin Solders
- 18-8 Mo Stainless Steel (active)
- 18-8 Stainless Steel (active)
- Ni-Resist (high Ni Cast Iron)
- Chromium Stainless Steel, 13% Cr (active)
- Cast Iron
- Steel or Iron
- 2024 Aluminium (4.5 Cu, 1.5 Mg, 0.6 Mn)
- Cadmium
- Commercially pure Aluminium (1100)
- Zinc
- Magnesium and Magnesium Alloys

Active or Anodic ↓

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Reasons for Treating Closed Systems

- Prevent corrosion and maximize efficiency.

- Metals corrode to various degrees depending on;
  - Metal combination
  - Oxygen concentration
  - Environment factors

- Corrosion can cause
  - System failure
  - Heat transfer loss
  - Blockages form corrosion products iron oxide

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Chilled Beams

- Technical Alert created back in 2007
- Increasing usage in new and refurbished buildings
- Chilled beams create some concerns
  - No alkali cleaning products
  - Commissioning limitations
  - Water treatment selection

- Recent example
  - Connection hoses
  - Wrong choice of materials

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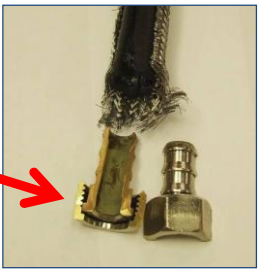
Actual hose that failed

Nickel plated swivel nut and hose barb



Zinc alloy failed hose barb

End views male nipple missing

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LTHW boilers with aluminum heat exchangers

- MODULEX heating boilers
- Supplier Automatic Heating
- Aluminum heat exchanger
- Starting to appear

- Supplier specifies Sentinel X100 inhibitor
- Inhibitor dosage rate is 1% by volume
- Price is five times that of conventional inhibitor

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Chemical Dosing Equipment

- Continuous inhibitor addition
- Automated bleed control
- Dual biocide dosing systems

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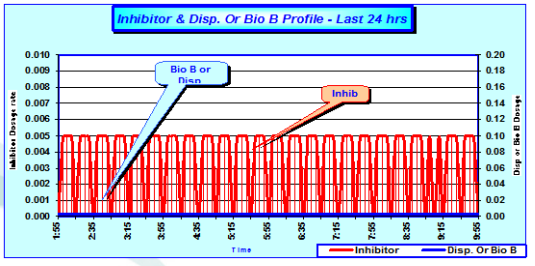
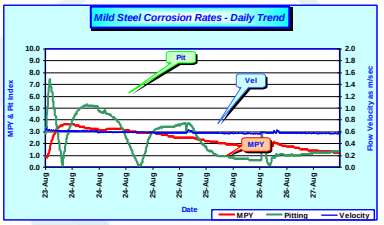
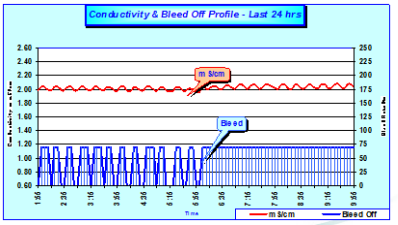
Water Treatment Monitoring







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Cooling tower filtration advantages

- Maintain heat transfer efficiencies
- Increase system life
- Reduces treatment chemical costs
- Reduces maintenance
- Enhances effectiveness of water treatment program
- 0.025 mm of fouling = 10% efficiency reduction*

* ASHRAE 2000 System and Equipment Handbook

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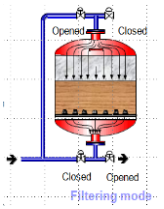
Cooling Tower Filtration Technologies

- Centrifugal Separators
- Sand and Media
- Cartridges, Bags
- Automatic self cleaning screen filters



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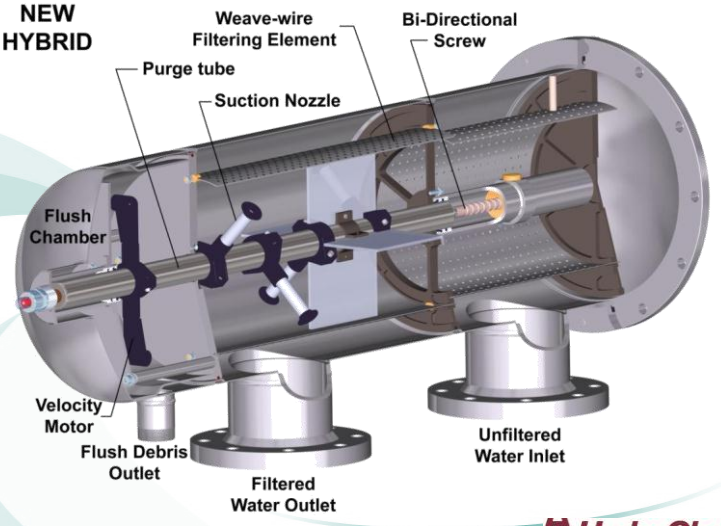
How they work



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Filtration

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Typical Cooling Tower Filtration Layout

- Determining number of eductor nozzles and layout
- Size of cooling tower basin determines number of eductor nozzles
- Number of eductor nozzles determines filtration flow rate
- Basin profile determines eductor layout

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Filtration Effectiveness

System off line for less than a week

System back online

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Hydrostatic Testing & Commissioning

- Comply with hydrostatic testing procedures
- Consider testing with air
- Ensure water treatment equipment
  - Installed
  - Operational
  - Prior to commissioning

- Consult with WTSP prior to each stage
- Contact WTSP for all top ups or drain down

Commissioning

- Never run system without inhibitor
- Initial treatment requires
  - Ensure entire system is open for circulation
  - motorised valves, all package units, loop blanked off flow & return lines.
- Don't create dead legs

Dead Legs

Consider dead legs such as:

- Balance lines
- Future connections
- Flow and return headers
- Automated bypass valves
- Auxiliary equipment

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Design in Safe Access

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If you have any questions please contact me on:

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Google's data centre in Saint Ghislain, Belgian - water storage tanks below the cooling towers