Using Air-Cooled Heat Exchangers To Minimize Water Requirements

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www.hudsonproducts.com
Induced Draft Fin-Fan® Air-Cooled Heat Exchanger

Bare Tube Bundle with Plug Style Header Boxes

Redwood Cooling Tower
Hudson Companies

Hudson Products Corporation

Zamil Hudson Company Ltd.
Limited Liability Company
Purpose of ACHEs

Remove heat from liquid, gas, or vapor
**Induced Draft**
- Plenum reduces solar radiation effects
- Reduced hot air recirculation potential
- Better airside flow distribution
- Limits on air exhaust temperature.

**Forced Draft**
- Easier to maintain mechanical equipment
- Easier access to clean fins
- Requires less horsepower
- Fans not exposed to hot exhaust air
Large Scale Applications – Refinery / Chemical / Gas Transport
Large Scale Applications – Power
Large Scale Applications – LNG
Maturity of Technology

- High – basic technology has been in use for decades. Advancements continue to be made in the areas of:
  - Air Side Heat Transfer – Fin technology
  - Tube Side Heat Transfer – Tube surface/insert technologies
  - Power Consumption – Fan, Fin and Tube technologies
  - Noise – Fan, Motor, Drive technologies
  - Fabrication – Advanced welding processes, optimization
  - Service – Bundle cleaning, PM services, high reliability components
Applications – New versus Retrofit

- Difficult, but not impossible. Depends mainly on the following:
  - Application – simple expansion, trim cooler, or new process?
  - Space – do you have room on the piperack/ground/off shore platform for the extra unit(s)?
  - Pumps, Motors & Power – do you have enough pump capacity to overcome the added tube side pressure drop and enough electrical power to run both those pumps and the air-cooler fan motors?
Footprint / Scale

- General Rule
  - Dry Cooling > Wet Cooling
  - Range of footprint ratios is dependent on process and location
  - ACHES can be pipe rack mounted helping mitigate footprint issues
Economics – Air Cooling versus Water Cooling – “It Depends On …”

- Site criteria
  - Water availability
  - Legal restraints – use of water
  - Costs – energy and water
  - Site restrictions – noise, visual pollution

- Technical criteria
  - Ambient conditions – wet and dry bulb
  - Metallurgical requirements
  - Overall heat transfer rate
  - Design pressure
  - Process service size
## Maintenance Requirements

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost ($USD)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundle Cleaning - Internal</td>
<td>$2K to $5K/Bundle</td>
<td>2 to 5 Yrs</td>
</tr>
<tr>
<td>Bundle Cleaning - External</td>
<td>$1K to $3K/Bundle</td>
<td>Annual</td>
</tr>
<tr>
<td>Grease Bearings (Drive and Motor)</td>
<td>N/A</td>
<td>Monthly</td>
</tr>
<tr>
<td>Replace Drive Belts</td>
<td>$0.5 to $1K</td>
<td>1 to 3 Yrs</td>
</tr>
<tr>
<td>Replace Fans</td>
<td>$1K to $5K</td>
<td>10 to 20 Yrs</td>
</tr>
<tr>
<td>Replace Motors</td>
<td>$100/HP</td>
<td>5 to 15 Yrs</td>
</tr>
<tr>
<td>Retube Bundle</td>
<td>$10K to $50K</td>
<td>10 to 20 Yrs</td>
</tr>
<tr>
<td>Replace Bundle</td>
<td>$30K to $80K</td>
<td>10 to 20 Yrs</td>
</tr>
</tbody>
</table>
Selection Parameters

Thermal Optimization Parameters

- Lowest Annual Cost
- Lowest Capital Cost
- Lowest Noise Level

\[ \text{Lowest Annual Cost} \quad \text{or} \quad \text{Lowest Capital Cost} \quad \text{or} \quad \text{Lowest Noise Level} = FN \]

- Tube Diameter
- Fin Diameter
- FPI
- Tube Pitch
- Number of Rows
- Number of Passes
- Tube Length
- Bundle Width
- Bundles per Unit
- Air Flow and Fans

- \$/Btu
- \$/Sqft (Surface)
- \$/Lb
- \$/BHP
- \$/PWL
Thank You