Navy Techval Program

Technology Deployment Working Group
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Navy Techval

Magnetic Bearing Chiller Compressor

- What is it, how does it work?
- Data from projects
- Where does it work best?
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The Magnetic Bearing Chiller Compressor at a Glance

Drawing courtesy of Danfoss Turbocor Compressors, Inc.
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2 ea. 60 ton chiller compressors with magnetic bearings

NAS Jacksonville FL
MAGNETIC BEARING VS. RECIPROCATING COMPRESSORS
COMPRESSOR EFFICIENCY

EFFICIENCY (KW/TON)

CHILLER DEMAND (TONS)

- MAGNETIC BEARING COMPRESSOR
- RECIPROCATING COMPRESSOR
## JAX Data

<table>
<thead>
<tr>
<th></th>
<th>Compressor Efficacy</th>
<th>Plant Efficacy</th>
<th>Average Load</th>
<th>Average Compressor Power</th>
<th>Cooling Tower Power</th>
<th>Plant Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>New</td>
<td>.57 kW/ton</td>
<td>.61 kW/ton</td>
<td>75.4 ton</td>
<td>45.9kW</td>
<td>2.44kW</td>
<td>48.3 kW</td>
</tr>
<tr>
<td>Existing</td>
<td>1.02 kW/ton</td>
<td>1.04 kW/ton</td>
<td>76.7 ton</td>
<td>78.5kW</td>
<td>1.55kW</td>
<td>80.1 kW</td>
</tr>
</tbody>
</table>
### Cost for installation in Jacksonville

<table>
<thead>
<tr>
<th>Service</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Subcontractor (including compressor)</td>
<td>$95,150</td>
</tr>
<tr>
<td>DDC Subcontractor</td>
<td>$12,442</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$107,592</strong></td>
</tr>
</tbody>
</table>
The Table below presents a synopsis of the data collected for these three projects:

<table>
<thead>
<tr>
<th>Project Site</th>
<th>Project Type</th>
<th>$/KWH</th>
<th>Tons</th>
<th>Annual kWh savings</th>
<th>Annual Energy $ Savings</th>
<th>% Savings</th>
<th>Cost</th>
<th>$/Ton</th>
<th>Payback (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Diego 2006</td>
<td>Add 3rd compressor</td>
<td>$0.121</td>
<td>240</td>
<td>176,717</td>
<td>$21,206</td>
<td>40%</td>
<td>$178,787</td>
<td>$744</td>
<td>8.4</td>
</tr>
<tr>
<td>Newport Sep/Nov 2005</td>
<td>New Chiller</td>
<td>$0.115</td>
<td>80</td>
<td>227,760</td>
<td>$26,192</td>
<td>65%</td>
<td>$100,783</td>
<td>$1260</td>
<td>3.8</td>
</tr>
<tr>
<td>JAX Dec/Apr 2006/2007</td>
<td>Compressor Retrofit with Cond. Water reset</td>
<td>$0.054</td>
<td>120</td>
<td>284,407</td>
<td>$15,358</td>
<td>41%</td>
<td>$107,592</td>
<td>$897</td>
<td>7.0</td>
</tr>
</tbody>
</table>
The Table below is the simple payback using the incremental cost:

<table>
<thead>
<tr>
<th>Project Site</th>
<th>Tons</th>
<th>Annual Energy $ Savings</th>
<th>Incremental Cost</th>
<th>Payback (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Diego 2006</td>
<td>240</td>
<td>$21,206</td>
<td>$24,000</td>
<td>1.1</td>
</tr>
<tr>
<td>Newport Sep/Nov 2005</td>
<td>80</td>
<td>$26,192</td>
<td>$8,000</td>
<td>0.3</td>
</tr>
<tr>
<td>JAX 2006/2007</td>
<td>120</td>
<td>$15,358</td>
<td>$12,000</td>
<td>0.8</td>
</tr>
</tbody>
</table>
1. Quarterly tightening of terminal screws (could be done in conjunction with #2 once per year)  
   2 work-hours per service

2. Annual blowing dust off circuit boards  
   2 work-hours per service

3. Change capacitors every five years  
   8 work-hours per service plus $250 for capacitors

**Over 10 years that would be 96 work-hours plus $500 for capacitors.**
Other advantages of the compressor

- **Quiet** – In San Diego the chilled water pumps make more noise than the chiller. Could be a plus if installation is in an area where noise is an issue.

- **Light weight** – If compressor needs to be changed out, can be accomplished manually by two persons.

- **Low startup draw** – about 2 amps. Could be a plus if you are replacing or installing a backup generator since generator can be downsized to handle full load draw, not startup. Smaller generator may pay for incremental cost of compressor.
Best Places To Install Magnetic Bearing Chiller Compressors

• Relatively high electric rates (> $0.06 kWh)
• Long run hours at part load
• Where existing compressor is in need of replacement
Contact Information

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