



MACHINERY ANALYSIS

## Centrifugal Compressors – Monitor and Reliability Program

Centrifugal compressor trains include the compressor, driver and the auxiliary systems such as lube oil, gas seals, gearbox, etc. They are critical assets for many production facilities.

Operators require high and consistent reliability for these assets. A regular monitoring system is considered essential to meet the operating and reliability metrics.

The recommended monitoring approach includes these activities:

- Vibration monitoring
- Performance monitoring
- Data analysis and recommendations
- Coordinated approach to link monitoring with maintenance and reliability activities

### BETA Delivers Practical and Cost Effective Results

With decades of experience in managing reliability programs, Beta Machinery Analysis (BETA) has practical monitoring solutions that offer these advantages:

- **Remote Analysis.** This approach saves time and money, and is ideal for offshore facilities or other installations where a dedicated reliability team is not available.
- **Teamwork.** BETA's experts work closely with your reliability and maintenance staff to implement a predictive maintenance plan. This provides superior results (Figure 2).
- **Consistency.** Many traditional programs fail because of staff changes or other resource constraints. BETA's services ensure consistent attention to your equipment resulting in a smooth running program.
- **Cost Effective.** BETA's program is a fraction of the cost of other OEM driven approaches. You will be surprised at the reasonable monthly fee per machine. Even better, is that BETA does not require expensive software and hardware. We pull the "free" data from your existing DCS or data historian.

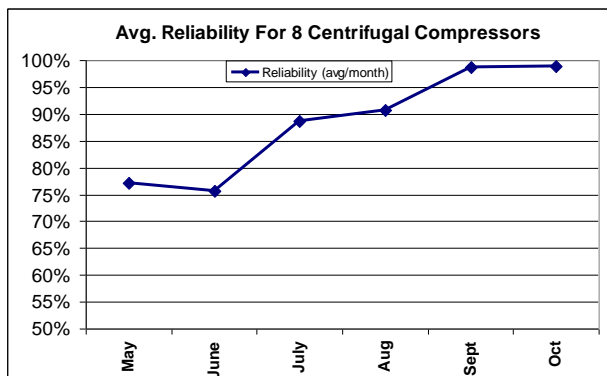


Figure 2. BETA's monitoring support helped achieve increased reliability for 8 compressor trains at offshore production facility

By trending performance variables, BETA’s program catches many more problems than a traditional “condition based monitoring program” that is focused on vibration measurements. Figures 3, 4 and 5 illustrate a few common issues identified by looking at the entire compressor system, including the driver.

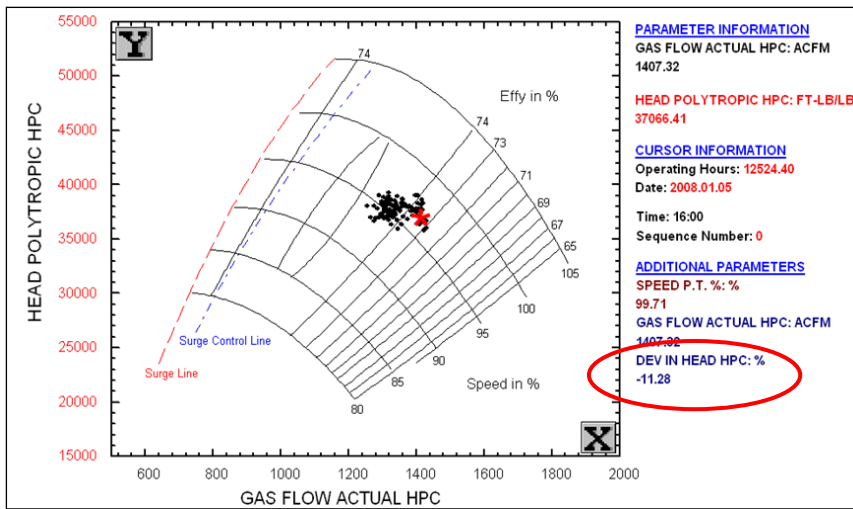


Figure 3. Compressor performance monitoring finds head significantly below baseline

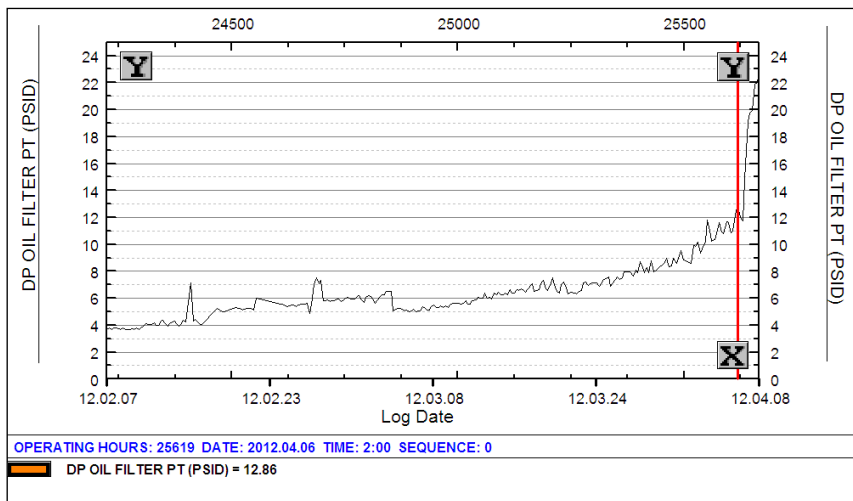


Figure 4. Lube oil system; pressure drop across filter indicates immediate action required

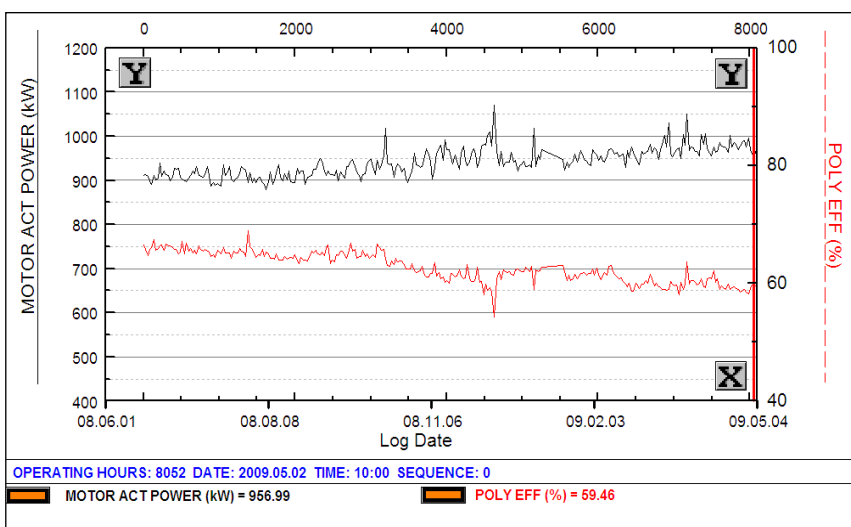


Figure 5. Monitoring motor reveals rising power due to declining efficiency

## BETA's Service Offers Complete Protection

Component		Monitored Parameters/Attributes
<b>Centrifugal Compressor*</b>	Compressor performance	<ul style="list-style-type: none"> <li>- head</li> <li>- efficiency</li> <li>- process power</li> </ul>
	Lube oil system	<ul style="list-style-type: none"> <li>- pressures</li> <li>- temperatures</li> <li>- cooler efficiency</li> <li>- filter differential pressure</li> </ul>
	Vibration	<ul style="list-style-type: none"> <li>- overall vibration from proximity probes</li> <li>- spectral analysis</li> </ul>
	Bearings	<ul style="list-style-type: none"> <li>- temperatures</li> <li>- orbits</li> </ul>
	Thrust balance	<ul style="list-style-type: none"> <li>- axial position</li> <li>- thrust bearing temperatures</li> </ul>
	Gas cooler performance	<ul style="list-style-type: none"> <li>- temperature drop</li> </ul>
	Scrubbers	<ul style="list-style-type: none"> <li>- liquid level</li> <li>- pressure drop</li> </ul>
	Dry gas seals	<ul style="list-style-type: none"> <li>- gas pressures</li> <li>- filter differentials</li> <li>- flow rates</li> </ul>
	Recycle	<ul style="list-style-type: none"> <li>- surge margin</li> </ul>
<b>Gearbox</b>	Vibration	<ul style="list-style-type: none"> <li>- overall vibration from proximity probes</li> <li>- spectral analysis</li> </ul>
	Bearings	<ul style="list-style-type: none"> <li>- bearing temperatures</li> <li>- orbits</li> </ul>
<b>Driver* (i) Gas Turbine</b>	Inlet filters	<ul style="list-style-type: none"> <li>- differential pressure</li> </ul>
	Axial compressor	<ul style="list-style-type: none"> <li>- discharge pressure</li> <li>- deviation from baseline</li> <li>- inlet vane position vs. schedule</li> </ul>
	Fuel gas system	<ul style="list-style-type: none"> <li>- pressure vs. compressor discharge pressure</li> <li>- flow rate</li> <li>- thermal efficiency</li> </ul>
	Turbine performance	<ul style="list-style-type: none"> <li>- inlet temperature deviation</li> <li>- temperature spread</li> </ul>
	Lube oil system	<ul style="list-style-type: none"> <li>- pressures</li> <li>- temperatures</li> <li>- cooler efficiency</li> <li>- filter differential pressure</li> </ul>
	Bearings	<ul style="list-style-type: none"> <li>- bearing temperatures</li> <li>- orbits as applicable</li> </ul>
	Vibration	<ul style="list-style-type: none"> <li>- overall vibration from proximity probes</li> <li>- casing vibration</li> <li>- spectral analysis</li> </ul>
<b>Driver* (ii) Motor</b>	Electrical	<ul style="list-style-type: none"> <li>- phase currents</li> <li>- real power</li> </ul>
	Vibration	<ul style="list-style-type: none"> <li>- overall vibration from proximity probes</li> <li>- casing vibration</li> <li>- spectral analysis</li> </ul>
	Windings	<ul style="list-style-type: none"> <li>- temperatures</li> <li>- temperature spread</li> </ul>
	Bearings	<ul style="list-style-type: none"> <li>- bearing temperatures</li> <li>- orbits if applicable</li> </ul>

\*BETA has monitoring solutions for other equipment, such as, reciprocating compressors, pumps, expanders, engines and steam turbines



Vibration and Performance Monitoring on compressor and turbine



Dry Gas Seal Monitoring – a critical component of the system



Troubleshooting support at gas pipeline facility

## BETA's Range of Monitoring and Support Services

- **Remote Vibration Analysis** – your operators collect the data and send to us for analysis
- **Onsite Vibration Analysis** – we visit your facility to monitor your equipment
- **Remote Vibration/Performance Monitoring** – the recommended approach for centrifugal compressors, reciprocating compressors, and other important rotating assets
- **Troubleshooting** – provide detailed analysis and advice on vibration issues
- **Performance Assessment** – check performance metrics and trends
- **Surge Control** – modeling and recommendations for managing the surge control functions on your centrifugal compressor
- **Lateral and Torsional Analysis**
- **Small Bore Piping** – design and field solutions to address small bore piping problems caused by flow induced and acoustic induced vibrations, pulsations, and/or mechanical resonances
- **Other design and field services** – to support rotating machines including pulsation, vibration, structural dynamics, foundations, training, etc.

Since 1967, BETA has been a pioneer in providing reliability services for rotating machines. We have a global leadership in design support and we provide monitoring services for hundreds of sites.

Contact us for application support or more information on our monitoring and reliability services, [www.BetaMachinery.com](http://www.BetaMachinery.com)

