MAARS Application Note

Temporary Pump Monitoring Application

Vibration analysis of charging pumps has proved to be very successful in solving vibration-related machine failure at a chemical production facility. However, routine data collection intermittently indicates that the charging pumps may be experiencing cavitation.

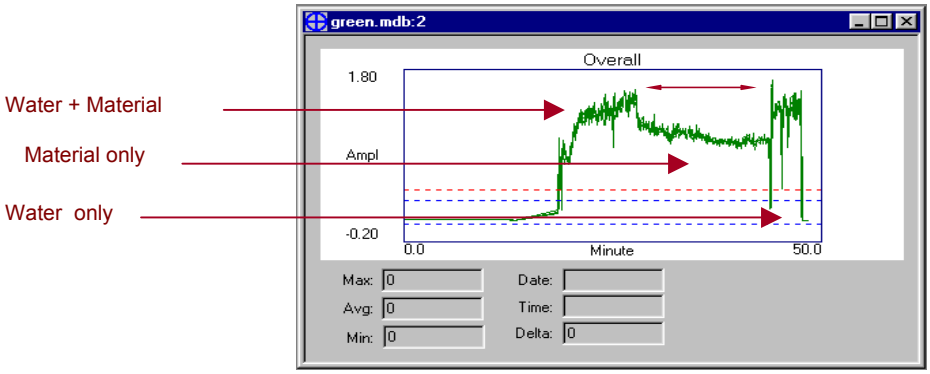
Problem Statement

The Model 5000 Monitoring Unit from MAARS, Inc. was employed on three pump trains at a chemical manufacturing plant to identify the root cause of repetitive seal failures. Installed only about 4 years ago, seals were failing on these pumps about every 3 or 4 months. The area is a Class I, Division II area, which means that there is a possibility of explosion if seal failure occurs. A "hot work" permit was required, and a "sniffer" was employed for the duration of the test. Each pump train consists of two pumps in series, spaced about 5 feet apart. Four pump trains exist, but one was down for unplanned repair at the time of the test. The pumps run intermittently, on for about 1 hour, off for about 2 hours. These pump lines cost about $50,000 per day when down for unplanned maintenance.

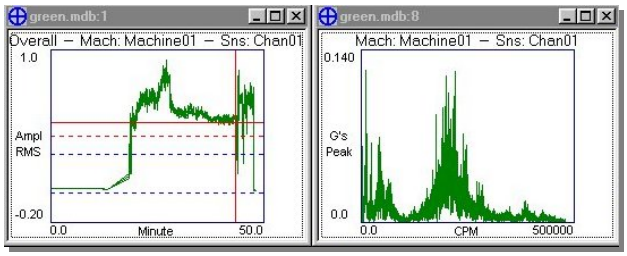
Vibration Analysis

Six sensors were configured for this special test. In addition, the analysis parameters were defined in the database to match those used by the machinery analyst, with one exception. The Fmax was extended to a higher frequency range (to 6Khz) than that used by the analyst. The analyst was using an Fmax of only 2.4 KHz. At this Fmax, NonSynchronous data was shown at only 5% of the total signal content by data collector. In order to perform the analysis, PathFinder™ Software and the live spectral and trend displays in the Model 5000 Monitoring Program were used. The Model 5000 was configured to collect a Spectrum, Waveform and Trend every 6 seconds for 1 hour run time, with 3200 lines of resolution.

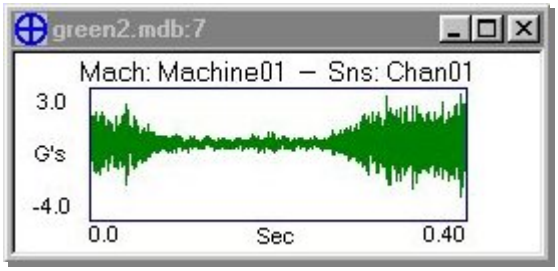
1. It was immediately obvious that during the beginning and end of the charging cycle the vibration amplitudes were chaotic. Usually the vibration amplitudes at the end of the cycle had wider amplitude swings.



2. The spectral data for these pumps was consistent across all points, with the higher amplitudes on the trend charts correlating with the presence of a "hay-stack" of energy in the higher frequencies. None of these peaks could be attributed to known bearing or other high-frequency energy (such as vane-pass), and all of the high-frequency data was analyzed and found unsynchronous with the shaft fundamental frequency or its harmonics.



3. The waveform data is modulated by the piping resonance, which the high frequency, broadband energy from the cavitation was exciting.



Analysis Results

Cavitation of the pump impeller as the materials being pumped change as part of the process cycle was found to be the problem leading to seal failure. The pumps are cavitating when water + material at beginning of cycle and only water is being pumped at end of cycle. This explains why routine data collection never found the problem, and why "temporary" continuous monitoring is important. These pumps are operating off their operational curves during the beginning and end of the charging cycle. Our recommendation is that the plant process engineers need to redesign the pump configuration or change the specific gravity of the material used for the cleaning cycle.

Contact Information

If you have problem pumps in your manufacturing plant, please call MAARS, Inc. at (865) 927-6626 or email us at sales@maars.com.