Emerson Vibration Analysis and Balancing Services Help ZADCO Avoid Unscheduled Downtime

RESULTS

- Avoided unplanned prolonged outage of water injection booster pumps
- Contributed to the prevention of potential production losses
- Prevented potential pump breakdown on two key pumps
- Preliminary analysis by ZADCO rotating machinery team manager led to proactive mobilization of Emerson team and solved flywheel imbalance issues
- Improved plant uptime and overall reliability

APPLICATION

Five critical water booster pumps supplying inventory to water injection turbopumps operate on the ZADCO offshore oil platform, maintaining crucial reservoir pressure in order to produce crude oil from the oil field. The produced crude is pumped via main oil lines to Zirku Island for processing.

CUSTOMER

Zakum Development Company (ZADCO), part of Abu Dhabi National Oil Company (ADNOC), is one of the largest oil companies in the Middle East. Tasked with developing one of the largest offshore oil fields on behalf of ADNOC and for the benefit of the shareholders in a joint venture between ADNOC, ExxonMobil, and Japan Oil Development Company Ltd. (JODCO), ZADCO operates many platforms, process/facility islands, and well head platforms in the fourth largest oil field in the world.

"Balancing our operation-vital pumps on-site (in situ balancing) helped us to protect critical machinery and avoid costly production downtime. It proves that ZADCO's unique integrated condition monitoring program backed with Emerson's (UAE-based) services support platform is working effectively toward operations excellency."

Slahadin Ali Ashair
Manager Rotating Machinery
Maintenance Support
ZADCO

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CHALLENGE

ZADCO oil production relies on five injection water booster pumps at its platform, which are critically important for pumping/supplying inventory to water injection turbopumps to maintain reservoir pressure and control for ZADCO oil production. At any given time, four out of the five pumps must be operating in order to ensure consistent production.

The pumps' fleet maintenance strategy is governed by a ZADCO condition monitoring program based on ZADCO's innovative condition monitoring policy and procedure No.: S0001-PB-STD-G-0003 Rev.0, which consists of periodic surveys for vibration, lube oil, acoustics emissions, thermography and performance monitoring protocols.

In June of 2016, the site's frontline maintenance team reported high flywheel bottom bearing temperature at its danger value of 82 degrees Celsius coupled with overall high vibration of 15mm/sec on the pump. At the time, another of the plant's pumps was already off site for planned overhaul by the ZADCO onshore rotating machinery team. This left the platform running at its minimum of three pumps (with one of them overdue for overhaul), creating high risk for a breakdown that would cause potential production loss.

ZADCO's rotating machinery team analyzed overall vibration, temperature data trends and history records. The records showed high flywheel bottom bearing temperature, but did not offer enough detail to diagnose the specific issue. Sending the pump away for maintenance was not an option due to the inherent production risk of running with only the minimum number of pumps and because of the high cost and time involved in moving equipment from the offshore platform to onshore (e.g. logistics, weather, etc.).

SOLUTION

Because the oil field platform is remote, resources and personnel are limited to ZADCO's integrated condition morning program. As a result, ZADCO has contracted with Emerson for vibration monitoring, data collection, and analysis since 2014. The contract provides technicians who visit on a monthly basis to perform additional integrated condition monitoring services.

When the site's frontline maintenance team reported flywheel bottom bearing temperature at its high values on pump "B", the ZADCO rotating machinery team analyzed overall vibration and temperature data trends and history records. The records showed that there was a problem with the pump flywheel, but was not enough to diagnose the specific issue. Based on the pump's specific design features (canned WEIR vertical pump assay consists of three lumped rotors connected with two coupling assemblies featuring heavy flywheel assay to maintain limits timed for downstream injection pumps during power blackout as well as previous history of DOM (Design Out Maintenance), ZADCO's rotating machinery team manager expected that the most probable cause of high vibration and temperature was flywheel imbalance. In response, he requested Emerson vibration experts carry out vibration diagnostics and in-situ balancing at a glance.

"In-depth vibration analysis helped us to prevent catastrophic equipment failure and avoid expensive repairs on our critical assets."

Mohamed Abdulrahman Al Marzouqi
Vice President Maintenance Support
ZADCO

Emerson engineers mobilized to site and began a more in-depth and immediate diagnosis. Using the AMS 2140 Machinery Health Analyzer, the engineer was able to detect high amplitude peaks in waveform data that quickly and accurately identified the root cause of the temperature and vibration increases. All data collected by the AMS 2140 was uploaded to AMS Machinery Manager where the engineer could perform detailed analysis, including detection of bearing faults using detailed vibration data.

Using the detailed vibration data, the Emerson engineer quickly identified an imbalance in the flywheel bottom bearing which confirmed the ZADCO rotating machinery manager's expectations. The engineer was able to perform dynamic balancing on-site, bringing bearing temperature within normal range and reducing vibration from 15mm/sec to 3.5mm/sec. On-site balancing allowed ZADCO to return the pump to operation as quickly as possible and avoid any risk of running fewer than three pumps.

After one month, the other pump ("A") that had been off-site for service was reinstalled, and displayed similar high temperature and vibration readings to the previously balanced pump "B". However, ZADCO had expected this, and proactively mobilized Emerson engineers for another analysis and insitu balancing that immediately fixed the problem. By bringing the engineer to site for the pumps' insitu balancing rather than shipping them to maintenance facilities onshore multiple times, ZADCO was able to avoid the risk of a production losses.

In remote locations where personnel and equipment are more costly, it can be difficult to stay ahead of equipment failure to avoid production loss due to downtime. ZADCO was able to save significant time and money by partnering with local experts for advanced data collection and analysis.

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