Marine industry

Technip

SKF Microlog Analyzer GX-S

SKF @ptitude Analyst software

Engineering Consultancy Service

Slewing bearings

Proactive condition monitoring offers huge cost savings across the board

A proactive condition monitoring programme, developed by SKF for its customer Technip, a world leader in engineering, technologies and project management for the oil and gas industry, could offer ship owners and operators the opportunity to defer some of the more onerous and costly insurance/risk classification agency-driven maintenance procedures.

In this instance, the three-year long worldwide annual support agreement formulated by SKF provides annual vibration surveys on critical crane slewing bearings on Technip vessels. These surveys are designed to give Technip enough informative and proactive data that, when combined with good planned maintenance records, and signed off by an industry expert, will enable Technip to increase the time interval between the usual invasive crane maintenance and inspection periods that requires dry docking; such as those dictated by the Lifting Operations and Lifting Equipment Regulations (LOLER), DNV risk management and Lloyds Insurance.

Offering condition monitoring engineers with marine backgrounds and experience in submarines to super tankers, SKF is in a remarkably strong position to address maritime applications; both from a component and maintenance perspective. SKF has a ten-year relationship with Technip; indeed SKF was responsible for the design of the bearing system used to support the two, 2,800 tonne reels on Technip's flagship vessel, Deep Blue, which is currently the world's largest reeled pipe laying vessel. It therefore made perfect sense that SKF should get involved in Technip's critical maintenance practices.

The simple question from Technip, *"Can you monitor and measure the condition of the slewing bearings in-situ on the cranes on our pipe lay vessels?"* belied a whole host of challenges; most of which centred on the fact that cranes move very slowly and rarely complete a full revolution.

According to Gerald Rolfe, Executive Business Manager for Marine *"Most condition monitoring companies will shy away from slow-moving applications such as cranes, because it is very hard to interpret the data."*

Rolfe explains, *"In normal rotating machine applications, a single vibration sensor will be able to measure a suitable frequency range due to the faster shaft speeds. In slower-moving applications, the frequency and amplitude level is a lot lower and it often becomes difficult to distinguish between a fault-generated signal and background noise."* Originally developed for higher frequency condition monitoring applications, SKF applied its unique Enveloped Acceleration (gE) technique to see if it would be as effective for lower frequency applications. By looking at the peak differences and their repetitive nature, it discovered that a derivative can be used to isolate the required fault signals from the background noise.

"We found that long time-domain measurements, using the gE approach worked remarkably well for low speed machines," Rolfe elaborates, *"Some slewing bearing never turn a full revolution, but they do have hundreds of rollers. What our engineers did was put a sensor in one position and then got the crane operator to complete a part or full revolution. This was then repeated for different sensor positions around the ring. All of the data collected was then analysed using SKF proprietary software tools and, just as importantly, was critically examined by our expert condition monitoring engineers, using their knowledge and experience to spot patterns and anomalies that might not be so obvious within the software alone."*

SKF are also introducing new methods to display the vibration data as a circular plot, allowing specific problem areas to be more easily visualised and pinpointed precisely.

"On one test bearing we were able to isolate a regular pulse that appeared six times per revolution," Rolfe continues, *"From the software and the engineers' analyses, we were able to ascertain that the bearing was not mounted on a flat surface. Although not causing a major issue at the time of survey, it is well understood that incorrect mounting surfaces can greatly increase internal stresses and have a dramatic effect on the useful service life and performance of a bearing. Using this instance, SKF were able to demonstrate the in-depth nature of the condition monitoring programme, giving Technip the confidence to expand the programme more widely across their fleet of ships."*

The current marine classification rules dictate an intrusive visual inspection of crane bearings every ten years, to provide assurance of the physical condition and integrity of all components, to ensure continued safe operation in service. *"Although this may sound relatively straightforward, this is a major undertaking for our vessels,"* explains Philip Watson, Crane and Hydraulic Systems Superintendent at Technip's Westhill, Aberdeen facility. *"Even if we plan for the spare parts we need to be available, the inspection process can still take up to two weeks in dry dock. When you look at the typical utilisation rates for the specialist pipe lay and support vessels operated by Technip, you can understand why two weeks of downtime is not an economically viable option."*

Watson continues, *"By applying an alternative, non-invasive condition monitoring maintenance regime, which applies a range of techniques such as; regular grease samples to check for internal wear and contamination; rocking tests to detect excess clearances and wear; vibration analysis for bearing surface condition; and ultrasonic inspection to check for potential cracks in the bearings, we aim to continue working 24 hours per day."*

"What we are attempting to do," Watson explains, *"is to formulate a proactive condition monitoring regime that, combined with evidence of a well managed, preventative maintenance programme, is acceptable to the technical authority and the classification agencies, to allow us to extend the usual ten-year invasive inspection period. We have introduced analysis into the condition monitoring programme in an effort to exceed the normal guidelines and, over the past three or four years, this has helped to identify a number of significant issues on smaller slewing rings, and we are really starting to trust the results we are seeing."*

The next steps will see Technip create a maintenance portfolio for each slewing bearing, which will be formally presented to a third-party technical authority who can review the data and issue a certificate of dispensation. Once this certificate has been issued, Technip will be able to approach the classification agencies to request an extension to the normal inspection period, and also lobby for a future change in the rules based on the positive results of this proactive maintenance approach.

Watson concludes, *"The hope is that we will be able to postpone the visual inspection to a time that suits us – as part of a wider maintenance programme that could involve dry docking for other procedures. We are still in the early stages and we need more time to develop trend-based predictions, but it is looking positive and thanks to the help of SKF and its specialist marine engineers, we are confident of a positive outcome."*

SKF (U.K.) Limited
T: 01582 490049
marketing.uk@skf.com
www.skf.co.uk

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