Case Study

The PRO Services Solution

ITT Goulds Pumps increases efficiency in one of the world's largest oil and gas operations, based in Russia

Based in Russia, one of the world's largest oil and gas operations sent a claim to its original pump manufacturer, complaining of very high motor loads and high vibration levels on eight pumps.

Smooth operation of these pumps was critical for the start-up of the new crude oil distillation unit with a capacity of 12 million tons per year.

The specialists at the refinery performed pump vibration measurements during test runs of the pumps with water. Vibration ranged up between 9 and 11 millimeters per second in the various pumps. Vibration was higher at low flows and went down as flow increased to the rated duty point of 800–900 m^3/h. The vibration spectrums demonstrated predominance of the vane passing frequency and also some wide band noise, which was likely hydraulic in nature. Furthermore, the motors were overloaded in all pumps when flow rates were above 500 m^3/h. The OEM contacts on plant-related activities attributed this fact to high specific gravity of water in comparison with hydrocarbons.

The ITT Impact

With ITT, the Russian refinery has eliminated its motor overload and significantly reduced its vibration problem.

The customer repeated the test run with crude oil six months later and found that vibration had reduced, but it was still as high as 7 to 8 mm/s. The loads of the motors had gone down to the rated level, but the power margin was still small in the existing pump configuration.

All the pumps had been throttled down to a great extent. The discharge control valves were 40 to 50 percent open and the flow was at the rated levels of 800–900 m^3/h. This ability to deliver the required nominal flow, even with 50 percent throttling, indicated that the pumps were significantly oversized for the existing system's resistance and proved it was technically possible to trim the impellers.

Trimming the impellers would cause a considerable decrease to the motor load, reduced vibration and a higher degree of discharge through the valve opening, which would lead to a reduced loss in throttling power.

Throughout this critical period, the issues remained unresolved and the customer contacted ITT PRO Services in Russia for advice on finding a resolution.

ITT Russia's diagnostics specialist takes vibration readings from the problem pump after its impeller trimming.

The ITT family of industrial brands includes:

GOULDS PUMPS · Bornemann Pumps · Engineered Valves · PRO services · Blakers · Leat

With support from ITT PRO Services' professionals, the customer's refinery specialists calculated the minimum head required of the pumps to deliver the flow rates of 800–900 m^3/h and asked the OEM to trim the impellers to meet those recommendations. The OEM's representatives recommended very low values for the new impeller diameters and would not guarantee the results of the trimming.

Refinery specialists were not satisfied with the OEM's recommendations and felt they needed a quick and reliable solution to the problem. The refinery sent a call for help to fully engage the ITT PRO Services team in Russia.

The ITT PRO Services team responded quickly and efficiently to the customer's concerns about its competitor's pump equipment with a thorough and consultative approach. A team of technical specialists was sent to fully assess the situation, including a troubleshooter, a diagnostics specialist with necessary equipment and an experienced service engineer.

It was immediately clear to ITT PRO Services experts that the pumps were oversized for the conditions under which they were operating. The pumps had been heavily throttled, the motors were overloaded in all pumps when the flow rates were high, and pump vibration had increased significantly as flow rates had decreased.

Assessing operations, finding solutions

The ITT PRO Services team recommended using intermediate trimming diameters and implementing V-trimming in the vanes to alleviate motor overload and high vibration. However, this big crude oil distillation unit was very new and had not been in full operation. Consequently, the customer did not know what actual flows and heads (or duty points) were required for the pumps.

The ITT team spent several days on-site speaking with the customer's specialists and collecting and studying process data to help the customer correctly identify the required pump operation regimes.

Systematic improvements

Once the customer had decided on required duty points, the ITT team calculated the new trim, created trimming sketches and supervised the customer's disassembly, impeller trimming, rotor balancing, pump assembling, position installation and test run. Impellers have been trimmed in three pumps—one from each unit of technological equipment.

During the pumps' test run with crude oil, ITT performed thorough vibration diagnostics for all pumps and motors. They found possible issues with the bearings in one of the motors.

Recommendations to ensure efficiency

The ITT PRO Services team helped to identify and direct new pump operation points that fully meet the customer's needs, resulting in increased efficiencies.

The main problem with the motors' overload was completely eliminated and the vibration problem was significantly reduced. The ITT team determined that they had made the correct trimming to the impellers. They recommended keeping the modified trim until the pump was tested under real process conditions. Trimming the impellers to smaller diameters (as the OEM's plant contact had advised) would not have been advisable—it would not have affected the vibration much, since the vane passing frequency would no longer be the main component of vibration in the pumps.

The system is operating at a heightened efficiency and the ITT PRO Services team has recommended that the condition of the motor bearings needs to be maintained and checked on a more frequent basis. For example, the detailed vibration monitoring of the motor's bearings should be done once a week, by evaluating the high frequency vibration envelope, assessing the peak factor and/or employing the shock pulse method.

The customer is appreciative of the ITT PRO Service team's consultative approach and is extremely happy with the improvements that have been made.

The Russian Refinery at a Glance

Challenge

Reducing motor loads and high vibration levels without a clear understanding of flow and head requirements.

Solution

ITT PRO Services specialists analyzed the customer's process and pump requirements, and oversaw disassembly, impeller trimming, rotor balancing, pump assembly, pump installation and test run. ITT specialists used their skills in providing detailed vibration diagnostics, sharing their knowledge of pump design and applications, and offering their practical work experience with rotor trimming and balancing, as well as pump assembly.

Results

The Russian refinery has eliminated its motor overload and addressed the vibration problem, thanks to ITT PRO Service's ability to analyze, diagnose and modify competitive pump equipment.