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Reliability, Energy, and
Maintenance Solutions

ITT Analysis Helps Texas Refinery Make Pumps A-OK for New API Standards

Recommended upgrades lower maintenance costs by 75 percent, emissions by 95 percent

Since 1919, the American Petroleum Institute has represented all aspects of the oil and natural gas industry. On behalf of more than 400 member companies, API negotiates with regulatory agencies, conducts research, educates the public and certifies equipment. The organization also develops equipment standards designed to boost efficiency, improve safety and reduce environmental impact.

Centrifugal pumps used in oil and gas production are among the products that must adhere to API standards. Pumps are one of the industry's most familiar fixtures, moving raw product through a complex refining process and into the pipelines that ultimately deliver energy to end-users. The API standards themselves are refined as government regulations change and new performance or safety needs are identified.

One mid-sized Texas refinery, originally an American oil company that first began operations in 1917, employs about 1,500 pumps to maintain a refining capacity of up to 120,000 barrels of oil per day. Approximately 75 percent of the pumps are API pumps, used in all processing units.

CUSTOMER PROBLEM: Older Equipment Falls Short of New Standards

Two major revisions to the API pump standard recently encouraged refineries to examine the pumps responsible for critical aspects of their production operations. The first revision in January 2003 required double mechanical seals on API pumps instead of single seals, a change which lowers emissions and improves reliability and safety. The second revision was published in October 2004, improving the recommended "L over D" (L3/D4) ratio, where L is a measure of the pump shaft's bearing fit diameter at the radial bearing location, and D is the length from the centerline of the radial bearing to the centerline of the pump impeller.

Although refineries are not required to upgrade to API standards for emissions of less than 500 ppm, this ITT Goulds Pumps customer operated many older API pumps, some of which were "bad actors" with high maintenance costs and excessive emissions. Release of the new standard provided an impetus to review all of its critical pumps for reliability, API compliance and emissions performance.

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CASE STUDY

REMANUFACTURE AND REPAIR

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ITT SOLUTION:

Reliability Review Provides a Pathway to API Compliance

The Reliability, Energy and Maintenance specialists at ITT Goulds are dedicated to helping customers maximize pump efficiency for any application. The company has eight ITT PRO Services® centers that remanufacture, repair and make efficiency recommendations on pumps. Michael Mullen, operations manager of ITT's Houston PRO Services says that about 75 percent of his team's work is helping customers in the oil and gas business.

Mullen's team conducted a thorough evaluation of 30 API pumps at the refinery. They did a "C3" analysis – cause, cost and correction of problems – starting with a review of the original specifications and applications for each pump. They spoke with engineering, operations and maintenance personnel at the refinery to understand the specific pressure and flow needs of the process, which often changes after a pump is first installed. They analyzed maintenance records and conducted field studies which consisted of continual electronic data monitoring of flows, pressures, and temperatures to determine true operating conditions versus original design point to assess the pumps in operation. The data collectors were left on each pump for approximately one week for 24 hours a day per pump to ensure the whole range of true operating conditions would be captured and recorded.

The ITT analysis results in multiple types of efficiency recommendations.

- Upgrade the pumps by remanufacturing or replacing parts
- Re-rate the pumps by changing the pressure and flow
- Add technologies that boost efficiencies such as PumpSmart® intelligent controllers or the ProSmart™ predictive condition monitoring system

A primary objective of the analysis is to ensure that each pump can operate as near as possible to its best efficiency point (BEP) while supporting the needs of the process. "The bigger the better is not true with pumps," Mullen explained. "Pumps that are oversized will waste energy, have higher vibrations and have a lower mean time between failures than pumps that are optimized for the specific application."

Mullen's team recommended changes to all thirty pumps.

With the help of the Houston PRO Services® team, the customer has implemented 10 of the 30 pump upgrade recommendations in two years. After testing the benefits of the ProSmart monitoring system on a compressor unit and cooling tower pump train consisting of a turbine, gearbox and pump, the engineers have ordered additional ProSmart systems to monitor three new boiler feed pumps and a draft fan. These systems will use Ethernet and Modbus connections to provide monitoring information over internet. Once they are fully operational, the plant is also planning to install ProSmart systems in a new crude oil processing unit being constructed in 2008 to expand the plant's overall capacity.

Approximately ten of the 30 pumps analyzed have already been upgraded to meet the 10th revision of API standards. The upgrades include new API 10th edition power ends, improved L3/D4 shaft ratios, new API 682 compliant seal chambers, and the latest mechanical seal technology. The improved seals are based on API seal plans 52, 53 and 54.

Some upgrades have to be done immediately due to federal emissions standards, and others will be done on a case by case



basis depending on unit production schedules.

THE BOTTOM LINE:

If this customer continues to implement ITT PRO Services recommended corrective actions, a total estimated cost savings of more than \$2 million over a three year period would be achieved. With the 10 implemented so far, they have also benefitted from maintenance relief and more environmentally sound processes.

- Over two years, maintenance costs on the pumps that have been upgraded have been reduced by 75 percent, thanks to both an increase in MTBF and ProSmart condition monitoring.
- The refinery has reduced emissions by 95 percent on the upgraded pumps, removing them from the HRVOC (highly reactive volatile organic compound) list.
- The company said it hopes to add ProSmart monitoring to every machine over 250 hp in its new crude oil processing unit.

