KEEPING THE LIGHTS ON
PERFORMANCE INSURANCE FOR MISSION CRITICAL PUMPS IN A PEAKING POWER PLANT

A primary supplier of backup electrical power had been providing peaking power to cities in its territory for over four decades. Process conditions had changed several times over the years as federal emission standards required power suppliers to generate less and less pollution, but what hadn't changed was the reliability of the plant's two twin-screw Warren fuel pumps. Neither of them had failed even once in that time, despite their age of 40+ years. Yet as viscosities of the fuel had been reduced several times over the decades when process conditions were modified, the pumps now operated in a situation they were not designed for.

THE CHALLENGE

The customer's business focus is providing supplemental power to residential and commercial customers in its territory when the power grid becomes overloaded. The Warren pumps provide fuel to two separated turbines which generate the power. Each runs separately, with only one needed at a time to provide 100 percent of the plant's output obligations, and the second as backup if needed. The reliable, consistent performance of the pumps had given the plant a false sense of security, and the plant was not stocking any major or minor repair kits to respond to unexpected downtime if it ever occurred.

THE SOLUTION

CIRCOR's local authorized service center conducted a plantwide audit of the customer's equipment-based operations. Elements evaluated included aging equipment, mission-critical applications, and processes which had undergone dramatic system changes. With all three of these conditions found to be present, a run-to-failure approach on pumps more than 40 years old carried significant risks. Lacking in-stock major or minor kits, repair options would be much more limited and the power plant would have to wait much longer for a new replacement pump than would ever have been acceptable.

Recognizing their precarious situation, plant personnel partnered with CIRCOR's authorized service center to conduct a two-week comprehensive teardown, inspection and analysis on one of the two Warren pumps that had been sold new in 1979. The analysis and findings, with recommendations, included:

PUMP CASE

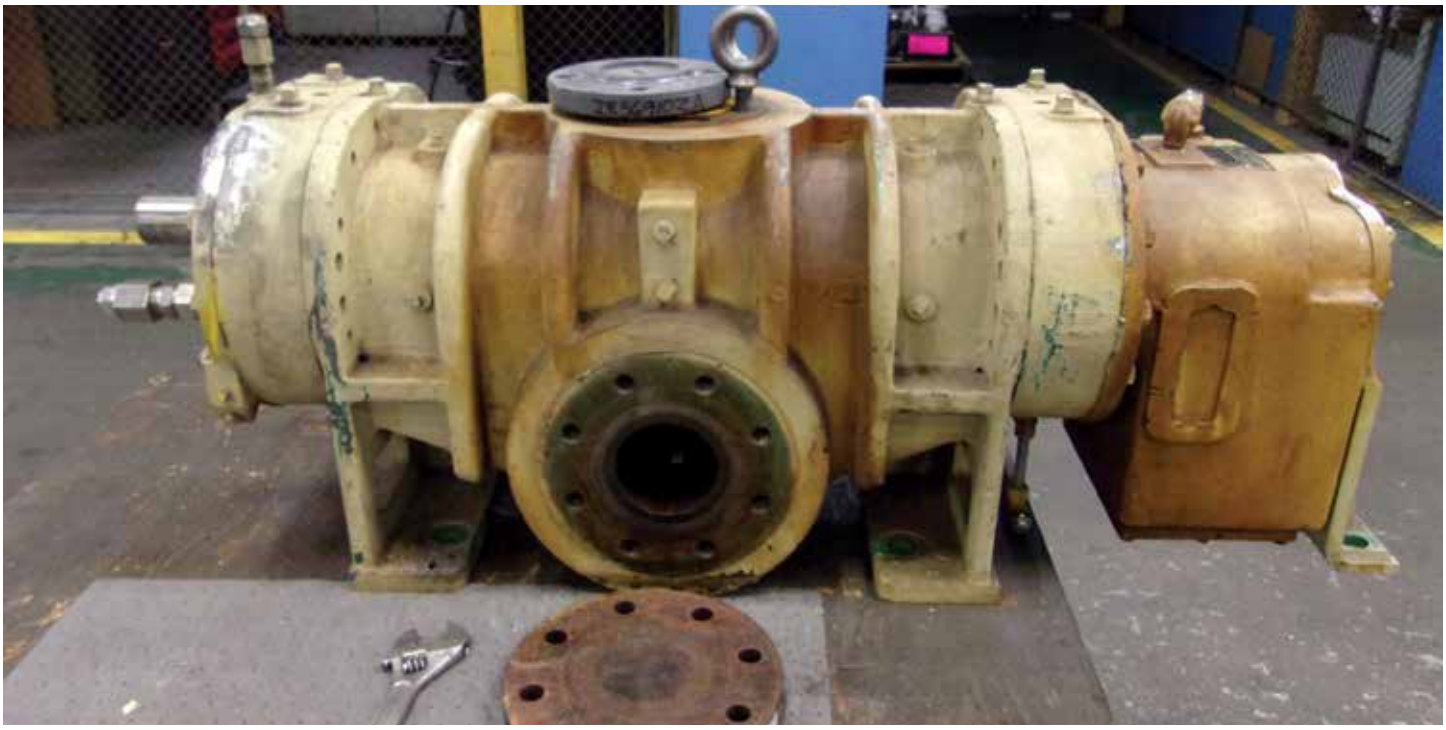
All four bore locations have areas of galling from screw contact in the suction and discharge areas. The bore inside diameters measure up to 0.0085" over the designed high tolerance. This body is cast iron and cannot be restored.

RECOMMENDATION: REPLACE

ROTATING ASSEMBLY

The screw flanks show excessive wear which is indicative of an improper timing of the screw shafts to the gears. Both sides of the flanks show contact. Both long and short shafts have detached coating on the suction and discharge ends of the screw. This matches the heavy contact areas noted above in the casing bores. Outside diameters measure both higher and lower than design depending upon the point of measurement. This is a result of wear as well as raised material on the surface of the screws from flank contact. The flank clearances measure as much as 0.012" which is 0.005" over the high tolerance. This added clearance results in a loss in delivered flow during operation. The timing gears show evidence of heavy fretting, and the inside diameter of the gear bores exceeds designed tolerance.

RECOMMENDATION: REPLACE; THE REPAIR PRICE IS MORE THAN 60% THE PRICE OF A NEW PUMP



BEARING BRACKETS

The front and rear bearing brackets require some minor cleaning to thoroughly flush the seal ports. Once this operation is completed these may be used as is. Cleaning and deburring would be required for repair.

RECOMMENDATION: REUSE

TIMING GEAR HOUSING AND FRONT HEAD

Both of these items are found to be useable in their current state. Again, cleaning and deburring are required for repair.

RECOMMENDATION: REUSE

MISCELLANEOUS PARTS

- Mechanical seals
- Bearings
- Lip seals
- Gaskets

RECOMMENDATION: ALL STANDARD PERIODIC REPLACEMENT ITEMS

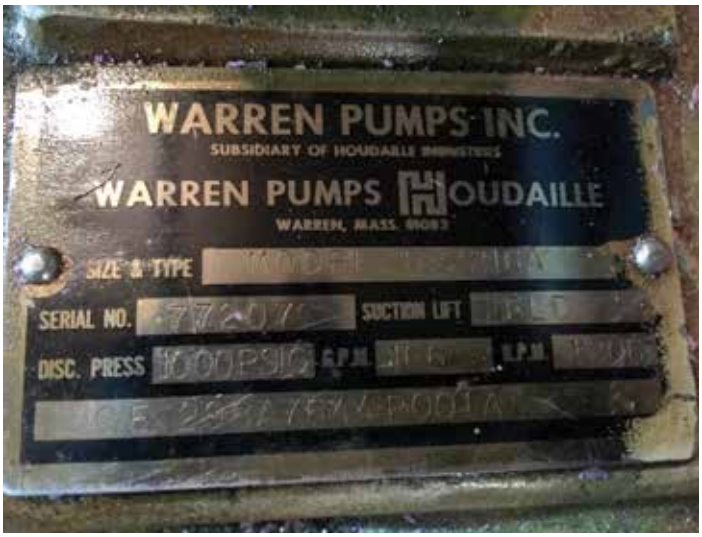
THE RESULTS

CIRCOR's bottom line finding was that improper timing of the screws had caused excessive wear to the screw flanks, preventing economical repair of the unit. The turbines operate on light fuel oil viscosity. Assuming a fuel oil viscosity of 44 SSU; the smallest pitch for a 1250 pump (0.875") at the highest rpm (1550); and a differential pressure of 1000 psig (as listed on the nameplate), a new replacement rotating element and reused body would still operate with a volumetric efficiency of only 30%, resulting in excessive pump slippage, inefficiency and heat generation.

Now in a position to make an educated decision on going-forward options, CIRCOR provided the customer with insight on the following:

- Options for replacement of normal wearing parts where simply reassembling and reinstalling the pump could make sense
- A detailed understanding of the state of all major internal elements, tolerances and wear
- Options for executing a minor or major repair
- Options to replace the pump

In the end, a minor or major repair was not viewed as an effective way to mitigate the power plant's risk due to the significant performance losses that would still remain. The decision was made to temporarily use the reassembled pump as an emergency backup and order a new twin-screw pump. CIRCOR's authorized service center reassembled the pump within a week for that purpose.



Upon successful installation of the new pump, the power plant took its second unit offline and executed the same process, with the same results and success. The customer now has the peace of mind that comes with knowing a risk of operational failure has been eliminated for many years to come.

Several months later, CIRCOR's authorized service center repeated the process again with a sister company of the power plant, one that performed the same function in a different territory.

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