

Service Solutions

Solving Problem Extends Pump Service Life

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PRO Project Engineers work with customers and our PRO Service Centers to solve our customers' pumping problems by analyzing pumping systems and providing turnkey solutions that make commercial sense.

Problem: A gulf coast refinery was experiencing excessive maintenance costs on a backup barrel charge pump (diffuser type). The pump is a 3x11 CB 12 Stage, Hydrocarbon Service, C-6 Metallurgy, 3560 RPM, 591 GPM, 5447 TDH, .8 Sp. Gr., 20' NPSHr, 23' NPSHa, 550-600 Deg. F, 1000 HP Motor Drive. The pump runs only short periods of time each year. Due to repeated patches and the inherent design of the original pump, the working tolerances and its reliability had exceeded all reasonable levels. The pump was the top priority of the facility for review and upgrade.

Due Diligence: To properly analyze this and all pumping systems, we first reviewed the current requirements of the pumping system to better direct our efforts.

Was The Pump sized correctly?

The pump was still sized correctly, as the system requirements had not changed dramatically enough, with regards to NPSHr, GPM, TDH and HP, from the original design requirements.

What mechanical and metallurgical issues need to be addressed?

As can be seen in the cutaway of the pump (Fig. 1), the rotor is a multi-stage design with impellers back to face through the length of the rotor. This requires a unique balance device with very defined dimensions. Without proper sizing the pump will thrust excessively. Thrust bearing failure could result in severe damage to rotor and diffusers. In this case the balance drum diameter had been modified over the years, which was adding to but not the main cause of the reliability issues.

After a complete inspection of the pump in our PRO Service Center, several areas of a mechanical and metallurgical concern were discovered. The pump was originally designed with a rotor that utilized shrink fit impellers with locating split rings on the shaft, which meets current design. The diffusers and barrel registers, however, were not within current design standards. The diffusers were fitted with a loose slip fit to each other, which allowed for a stack up sag (run out) in the diffuser assembly as shown in Fig. 2. This sag can easily allow wear parts to rub excessively while in operation. Current API running clearances are typically more liberal than the original design of these pumps. The registers of the barrel to covers were also found to be excessively loose due to years of use. The metallurgy for the wear parts in this pump were all standard heat treated 410 SS. Even with the recommended 10 Rc variance in the stationary and rotating parts, the short life of the parts merited a close look at a better selection for the working surfaces.

Solution: We proposed a complete weld up and re-machine of all registers between the diffusers. This would provide a tight fit, a more rigid bundle, and no stack up sag. The registers of the barrel to its covers were welded and re-machined to allow for a low clearance register fit. These register corrections allowed for a very tight pump assembly with little stack up sag. The wear parts were all replaced with new wear parts over-laid with Colmanoy #5 and #6 to give a harder, less galling surface, still with the required hardness differential. The pump has run successfully for several years now without any pump downtime. It was clearly viewed as a successful upgrade by the owners.

For more information on this upgrade or to explore an upgrade opportunity on another pump please contact your local PRO Service Center or Service Sales Engineer. ■

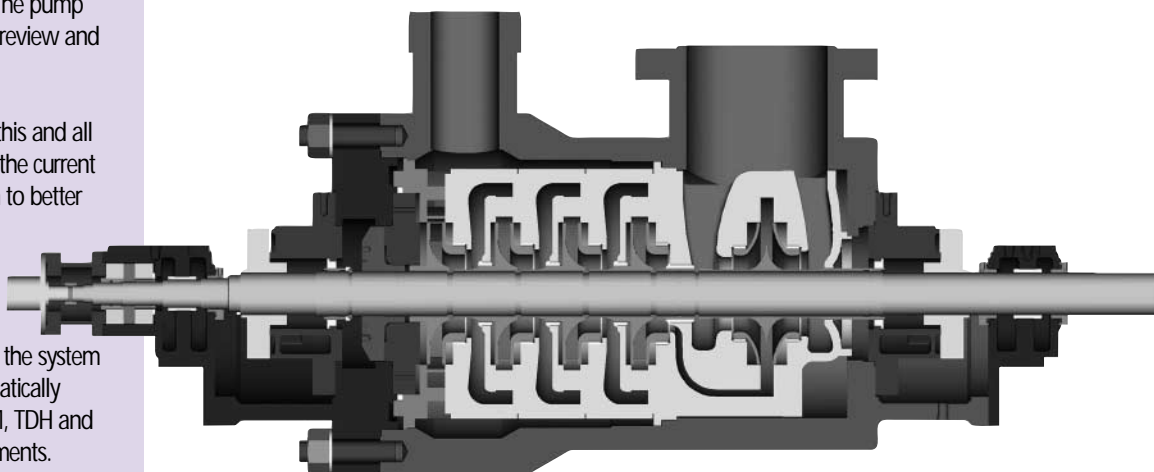


Figure 1.



Figure 2.

Send your comments or suggestions to:

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