

Service Solutions

Refinery Pump Re-Rate Saves Time and Cost

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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 three loading pumps due to extreme off Best Efficiency Point (BEP) performance requirements. Vibrations averaged .4 to .5 in/sec at all times. When the pumps were purchased the pumping requirements were thought to be 4800 GPM at 1137 TDH. Now the requirements have been defined as 2200 GPM at 1137 TDH.

Due Diligence: To properly address this pump modification we had to first review the exact requirements of the pumping system as it currently existed. Our objective was to provide the customer with both sound technical and commercial advise. The pump was clearly oversized from a capacity standpoint and needed a larger impeller than the case could currently utilize. The system requirement could not be met by the OEM. The solution options were to purchase a new pump from ITT (as we had the hydraulic fit) or execute a hydraulic re-rate on the existing pump. The customer was concerned with the risks associated with a re-rate when performed improperly. ITT PRO Services was able to provide ample customer references which allowed for a high comfort level on the equipment owners part. The issue lead time and the commercial impact of removing the old base and reinstalling the new and modifying the piping were weighed against the shorter lead time of the re-rate. The re-rate was dependent on the impeller casting availability only. This casting was easily expedited with minimal commercial impact. All other components were readily available. The re-rate was preferred if it was possible.

To completely examine the hydraulic issues we went to our family of curves for the API between bearing process pumps and found one that covered this application. We considered

complete flow range, head required, and NPSHa. We then had to match the existing volute with our new impeller to guarantee the hydraulic performance of these pumps.

All process pumps have two components that develop the head and maintain the capacity, the impeller and the volute (case). Energy is transferred from the driver through the coupling into the shaft and then into the fluid along the working side of the impeller vanes. This is the end of energy transfer from the driver. While energy is being transferred into the fluid, the impeller is also slowing the product down through a diffusion process (smaller area to larger area as the vanes develop from inlet to exit). This reduction in velocity head increases the pressure head as defined by Bernoulli. When the product is discharged into the volute it also is diffused to complete the head required of the pump. The product capacity is regulated by the impeller eye area and also by the volute opening area at the discharge of the impeller. These two areas are sized to define a certain capacity typically known as the Best Efficiency Point.

Solution: For our re-rate to work we had to take all these issues into account and then mechanically conform the existing pump to their requirements. In this case our impeller was dramatically smaller in capacity than the original with a much smaller area between shrouds and it had to be larger on the diameter to meet the TDH requirements. The volute therefore was required to have a much smaller opening at the

openings in the case and have a larger base circle (diameter at the volute tongue openings). This was engineered by receiving the case and completely mapping out the existing hydraulic passages (volute). The existing volute tongues were then removed and new ones were installed with much reduced areas and larger base circle. Once the hydraulic re-rate was complete we sent the pump to the factory in Seneca Falls to be performance tested. It performed very well hydraulically to our prediction and from a vibration stand point was able to perform within API 610 8th Edition current standards. Once the customer installed it in the field it performed even better.

Commercially this allowed the customer to spend about 35 cents on the dollar versus the total replacement of the pump with a new unit. The 35 cents included the removal of the pump by their personnel, the modification of the pump with new components in our PRO shop, performance testing, reinstallation of the pump by their plant personnel and all software associated with the job. The first pump with performance test was out of service for 28 days. The next pumps without performance tests were out of service for 16 and 18 days. Vibration readings averaged .07 in./sec. after this upgrade.

For more information on this re-rate or to explore a re-rate opportunity on your pump please contact your local PRO Service Center or Service Representative. ■■■

