



Pacific 4" AC barrel pump

Industry:	Oil + Gas - downstream oil
Region:	Americas
Territory:	USA
Category:	Re-engineering
API Type:	BB5

ClydeUnion Pumps Aftermarket Technical Services team has experience across a range of services on critical rotating and reciprocating equipment to improve operational safety, reliability and efficiency. The re-engineering of the Pacific 4" AC barrel pump for the oil and gas market is one of our success stories documented in our library of case studies. These case studies highlight the requirement from the customer, how we achieved the goal and the process we followed to deliver the improvements.

Image left: Damaged diffusers

Situation

To provide re-engineering on impellers and diffusers for a complete overhaul and upgrade for a Pacific 4" AC 4 stage.

Challenge

The existing rotor design is a stack up design where the impellers have a slip fit on the shaft. They are spaced on the shaft using shaft sleeves and all components are held in place up against a shaft shoulder by a common nut.

The balance piston is also located up against a shaft shoulder and held in place by a shaft nut. This design can lead to excessive runouts and a bowed shaft due to the faces and bores of all components not being exactly square and true.

Additionally, because the rotor has to be unstacked after it is balanced to allow it to be assembled with the inner bundle, it is virtually impossible to duplicate the runouts and balance on the rotor. The balance piston can also become loose on the shaft if the nut is not properly tightened.

The request by the customer was to repair existing impellers and fabricate new diffusers for limited down time.

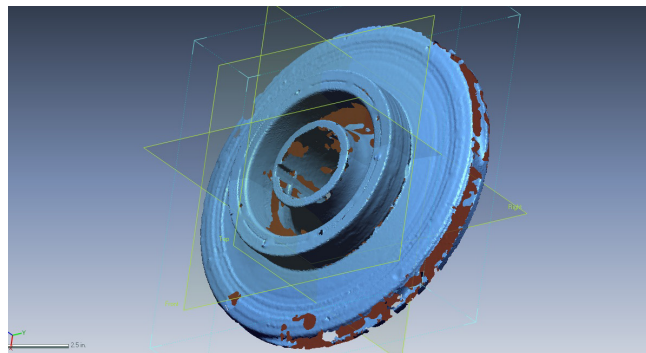
Utilising state-of-the-art, non-contact, laser base hardware and software technology, we provided a highly accurate scan data so that we are able to supply the customer with spare parts in the future.



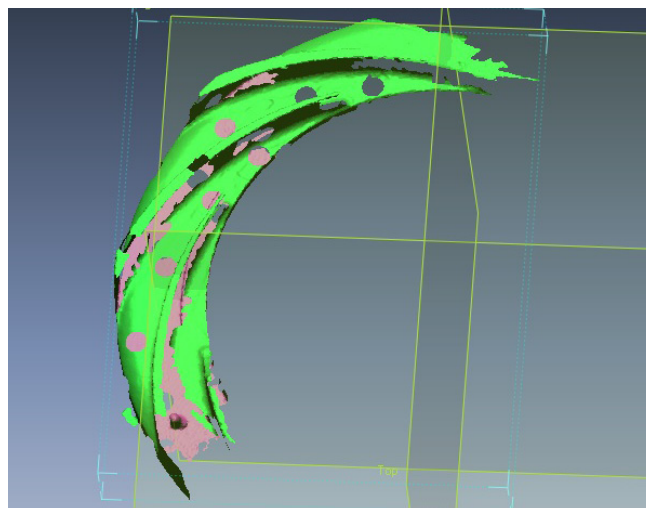
Damaged impeller

Solution

- The impellers have a shrink fit to the shaft
- The spacer sleeves were removed and replaced with shaft sleeves (with a interference fit to the shaft) against which the stationary bushings run
- The impellers and shaft sleeves were individually located on the shaft using split locating rings. The locating rings fit into a groove in the shaft and the impeller or sleeve slide over the ring to hold it into the groove
- As the pieces are individually located the chance of bowing the shaft or having excessive runouts is greatly reduced because the added affect of stacking the parts together is eliminated. It also increases the ability of repeating the runouts and balance of the rotor
- In the new shaft stepped design, each impeller fit is slightly smaller than the previous, this makes assembly and disassembly of the rotor easier
- The balance piston is held up against the shaft shoulder using a split locating ring. A nut threads onto the shaft and goes over the split ring to hold it in place. This reduces the chance of the balance piston coming loose or causing a bow in the shaft



3D scan of damaged impeller



3D scan of damaged diffuser

Operational improvements

Once the part is scanned and inspected, the file is electronically transmitted along with the engineer report describing the condition of the part and any operational history and improvement requirements discussed with the operator. If required, a full laboratory metallurgical failure mode analysis report can be arranged at this stage to better understand complex reliability problems. After analysis and review by the ClydeUnion Pumps design and improvement engineers, scanned data is then used to create a full manufacturing model and drawing of the part.

- Increased part strength and reduction of stress concentrations
- Improved or modified hydraulic design to increase efficiency, adjust pressure and flow characteristics and improve suction design to reduce cavitation damage
- Upgraded materials to stronger and more corrosion resistant ClydeUnion Pumps approved materials



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