CASE STUDY
REDESIGN OF VERTICAL PUMP
TREBLES MEAN TIME BETWEEN
FAILURE

- Redesign addressed origin of failure
- MTBF improved for under 1 year to more than 3 years
- Chemical leakage prevented, improving site safety

CHALLENGE
A post-installation modification to improve flow in a vertical chemical pump had weakened the discharge elbow. Subsequent cracking had been weld-repaired several times, but the pump was increasingly difficult to maintain. The customer asked ClydeUnion Pumps to undertake a redesign of the discharge elbow to prevent further deterioration.

SOLUTION
The modification that had caused the failure was undertaken originally because the gland ring outlets on the discharge elbow were not sufficient to evacuate the liquid passing around the head shaft. ClydeUnion Pumps therefore proposed a solution that would address this original issue as well as repairing the point of failure.

The solution was to re-design the discharge elbow and separate it in two parts: the elbow itself, above the support surface, and a suction spool under. ClydeUnion Pumps redesigned the upper section with vanes to make it stiffer than before and incorporated a new salvage pipe in case of leakages. The lower, suction spool section has been made as a single piece part to increase its solidity. The former three gland ring outlets have been replaced by one, and the liquid pumped is passed by five holes that represent an area equivalent to the former version. To prevent corrosion, the bearings were also upgraded to a material with superior wear and abrasion characteristics, plus better chemical compatibility.

OUTCOMES
The pump has been operating well since the upgrade. The change of bearings material has eliminated abnormal wear and reduced the MTBF from less than one year to in excess of three years.
- **Re-design of the upper part of the discharge elbow**
  This part is designed to be stiffer than the older version.
  It also integrates a salvage pipe for possible leaks.

- **Re-design of the lower part of the discharge elbow**
  (suction spool)
  A step-by-step manufacturing process was developed due to the necessity to alter dimensions for cladding after initial testing. Finally, calculations were made to predict the likely shrinkage of casing and cover fits after processing/cladding at 1,900 °F.

- **View of the assembly**

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**OPERATIONAL IMPROVEMENTS**

Since the upgrade and the change of bearings material from PTFE to Vespel® CR6100, there has been no abnormal wear of bearings. Before the MTBF for the PTFE bearings was less than one year. The pump is operating well with the new discharge elbow.

**FINANCIAL ILLUSTRATION**

Analysis on 3 years

- **Current version:**
  Expertise, overhaul of the entire pump + studies and supply of new designed parts = 70K Euros
  MTBF is currently more than 3 years.

- **Former version:**
  Maintenance cost required for bearings change and expertise of pump state = 20K /year
  Cost for 3 years = 60K Euros + spare parts + weld repair of discharge elbow > 70K Euros

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