



Design modification on VMBX pumps for LPG process

Industry:	Oil + Gas - gas plant
Region:	Middle East
Territory:	UAE
Category:	Mechanical design upgrade
API Type:	VS6

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 design upgrade of the VMBX pumps 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: Impellers, PEEK bearings and bearing sleeves damaged

Situation

An LPG process is running with eight VMBX pumps, during operation, these pumps faced high vibrations. After inspection and stripping of pumps, we found damage of impellers, wear rings and bearings along the shaft line.

Challenge

The damages observed on the pump components were typically the result of bad lubrication of internal bearings due to presence of gas phase in the liquid pumped. Presence of gas phase in liquid pumped can have several origins:

- Pump heavy cavitation (too low available NPSH, over-flow, clogged suction filter)
- Gas contained in the liquid pumped, gas pockets in suction line or in the pump barrel
- Sudden pump suction pressure drop
- Pump running with no flow (closed valve)



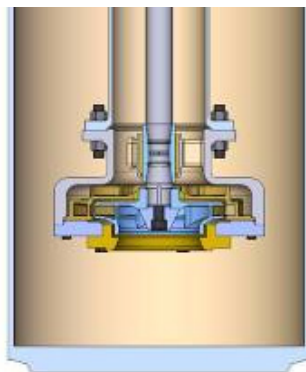
Impellers, PEEK bearings and bearing sleeves damaged

After examining the causes, it was established that the presence of gas pockets came from the installation itself (head losses along suction line, control of levels in storage tanks compared to vapour pressures of liquids pumped), and over-flow during pump start-up sequences. The request of the customer was to enhance reliability of the pumps despite non-optimal operating conditions without changes in the current configuration of the whole installation. The customer also wished to operate at higher flows than those originally required.

Solution

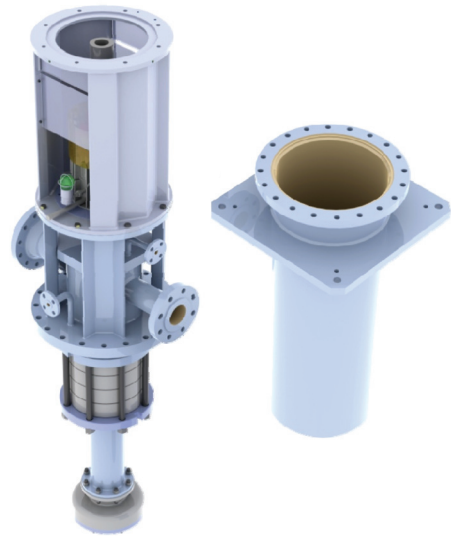
The solution consisted of changing the shaft line bearings material to improve their behaviour during pumping with presence of gas. We also supplied a specific design of suction stage to improve the re-pressurisation of gas pockets, and this way having better pumping conditions through the hydraulic package. Additionally, the design of this suction stage allows functioning at higher flows for unchanged NPSH.

- Disassembly and examination of the pumps
- Supply of graphite based bearings with high lubricant and anti-friction properties, this material improves pump behaviour during dry running (presence of gas)
- Supply of new bearing spiders to allow implementation of a set composed of graphite based bearing and metallic insert, this sub-assembly is more efficient from a maintenance point of view by avoiding machining and easing assembly
- Supply of new suction stage composed of specific impeller and diffuser
- Reassembly and performance tests



Operational improvements

- The pump is ready to be used on the LPG process with an improvement of MTBF by addition of a bearing material adapted to dry running conditions.
- Unavailability of the process during maintenance has been reduced thanks to the implementation of sub-assemblies comprising graphite bearing in a metallic insert ready to be assembled on the pumps.
- New suction stage will help to reduce problems of gas pockets and increase the production (operation at higher flows).



Financial illustration

- **Investment cost of part supplied**
 - Engineering studies and modification of the first pump 130,000 Euros
 - Cost of parts needed for modification of other pumps at site 40,000 Euros per pump
- **Cost savings**
 - Cost of two new mechanical seals and multiple overhauls on one pump by year
 - Cost of damaged parts to replace
 - Costs linked to specific procedures for cleaning
 - Savings due to increased availability of the process



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