New Zealand Refining Company
Bearing Solution

High Vacuum Column Bottom Pump

The New Zealand Refining Company ongoing issue:

The New Zealand Refining Company had long suffered from bearing failures in its high vacuum column bottom Byron Jackson pumps.

The Byron Jackson pumps P6107 A and B are of horizontal, two stage, radial split design with 280 kW_e electric motor drives.

Normal operating discharge pressure is approximately 30 bar g. with the pumping temperature being 360_o C.

The shaft support system consists of paired angular contact rolling element bearings for taking the thrust loads and split journal type plain bearings for the radial loads.

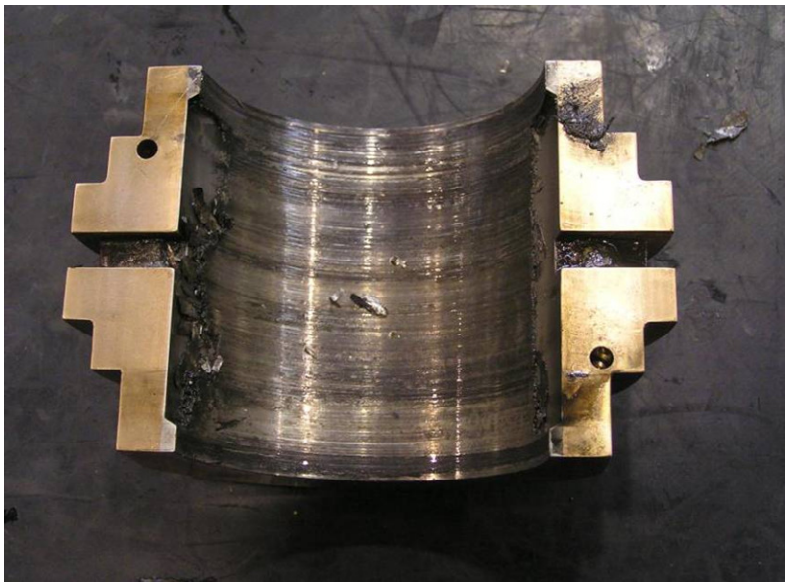
These bearings have steel or bronze backs with white metal linings and are lubricated with oil rings fed by a water jacketed sump fitted with constant level oil bottles.

Typical symptoms included discolouration of the lube oil due to white metal contamination and high temperatures observed on the bearing housings. Resorting to hand cut oil distribution grooves in the linings kept the problem under control, but whenever replacement bearings were fitted the problems re-surfaced.

Over time the shaft journals became damaged, but due to cost and time constraints any damage that was occurring was restored by hand dressing with the shaft left in place.

In 2006/2007 both the A and B pumps had new shafts installed during complete overhauls. This work was completed while the pumps where undergoing a project to install pressurised double shaft seals.

Once again the new bearings began to suffer with lube oil discolouration and high running temperatures being observed.



Wiped Bearing – Original Design

The Alloy Bearings Solution:

A fully wiped bearing raised the profile of the problem and prompted a call for assistance to a plain bearing specialist, Alloy Bearings.

The company staff had recently had experience with bearings in a power station turbine boiler feed pump that suffered from similar overheating and wiping problems.

Based on this experience they proposed a number of minor modifications to the bearing geometry and detail. The modifications were intended to maximise the flow of cool oil from the sump through the bearings thus increasing oil film thickness and reducing temperatures.

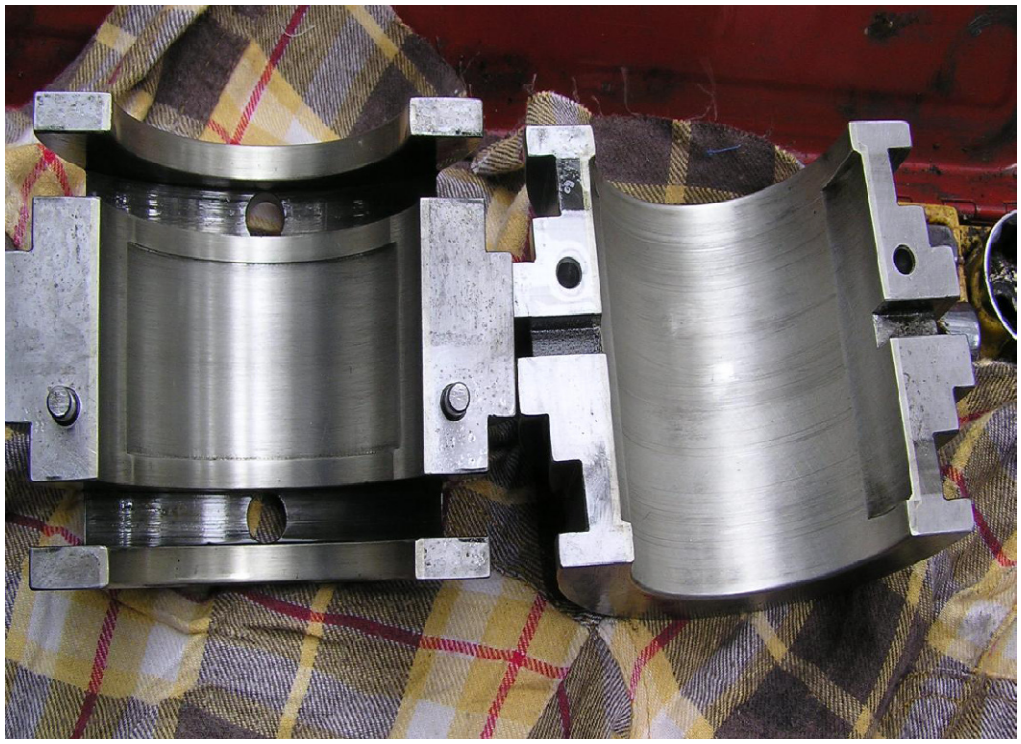
A careful review of historic vibration data was carried out prior to the manufacturing and installation of the new bearing design. During a QA review some of the design changes were considered to have the possible side effect of reducing shaft/bearing stability. No evidence could be found to substantiate this and the decision was taken to proceed.

A set of new bearings was installed in one pump in April 2008 to prove the upgrade and the modifications.

Oil samples which were taken shortly after start-up showed evidence of white-metal contamination. Several on-the-run oil changes were made and further oil samples revealed that contamination had ceased. The initial contamination was proved to be due to residual contamination from the previous bearing failures.

Operational tests were undertaken and the bearing housing temperatures were now 13 degrees C lower than previous.

After four months of use the pump was stopped for an inspection of the bearings. Close examination showed no evidence of overheating or abnormal wear patterns, but unfortunately some scratching of the bearings had occurred due to the early foreign particle contamination at initial start up.



New Design Bearing After Proving Run

The new bearing geometry and design is considered a complete success and replacement bearings have been ordered for the second pump.

Thanks go to the staff of Alloy Bearings and the NZRC Operations and Maintenance departments who helped solve this seemingly intractable problem.

A great effort by all those involved.

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