GPM Service and Repair leads the way to improved pump reliability in chlorine dioxide application.

Improving Axial Flow Pump Reliability in Paper Manufacturing

EXECUTIVE SUMMARY

Most modern paper is white. Pure white paper provides maximum contrast for inscriptions or printing and prevents color casting (or unwanted tinting) under artificial light. Additionally, because most ink is black, bright white paper results in the easiest possible reading experience.

Simply put, white paper works best, and globally we use a lot of it. Transforming brown lumber into white paper requires pulp to undergo a chemical bleaching process. Chlorine removes the lignin wood fibers that, when left alone, produce the brown paper we often see in grocery bags and cardboard packaging. The problem for manufacturers is that producing white paper requires the use of corrosive materials, which can be hard on equipment. The process requires pumping large amounts of chlorine dioxide (ClO2), which calls for a heavy-duty axial flow pump made of specific materials (titanium and 316ss, in this case) that can withstand the corrosive environment.

Although this is a tough application, the right pump—installed correctly with the right materials—can stand up to the task. For paper manufacturers, investing in the proper equipment is key. Paper production can come to a standstill when a chlorine-generating pump fails, and the potential safety hazards associated with a ClO2 leak are serious. When a chlorine-generating pump application was experiencing frequent premature pump failures and skyrocketing maintenance costs, the GPM Service and Repair team stepped in to help the customer address several issues.

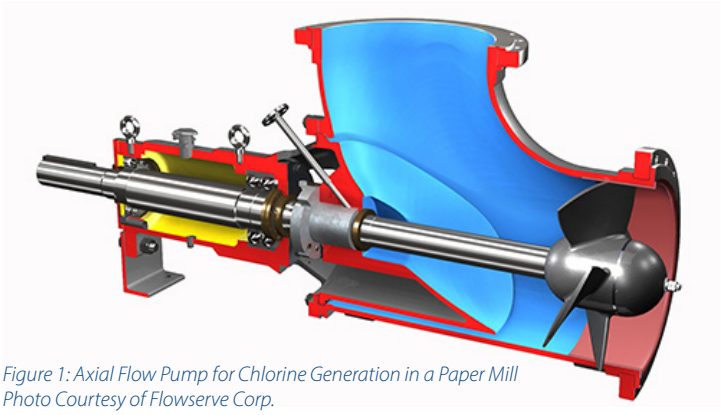

Figure 1: Axial Flow Pump for Chlorine Generation in a Paper Mill
Photo Courtesy of Flowserve Corp.

THE SITUATION

In a high-output paper manufacturing plant, productivity is critical to the bottom line. The last thing anyone wants is a series of plant-halting pump failures or heightened injury risks. Challenges like seal and bearing failures, broken shafts and pump failure - can cause operations to come to a standstill. It's not sustainable. It's not profitable. It's enough to give any paper mill maintenance manager a headache, especially in a critical application process such as chlorine generation.

Figure 2: Axial Flow Pump Rotating Assembly

In this case, our customer's pump shafts kept breaking during normal, daily operations. Because continued service and repair on the same pumps is costly, the team needed to find a permanent solution.

Our first step was analyzing the situation. Because the customer was experiencing repeat issues, we suspected extenuating factors beyond traditional problems like a breech seal or bearings failure. We checked for common issues, including pump misalignment, uneven or warped baseplate/structure, and drastic changes in the flow through the pump, which can stress the pump shaft and cause deflection. In this case, we found that the customer's pump was subjected to added stress at the first point of stabilization, the mechanical seal.

Mechanical seals are designed to stop liquid from migrating into a motor or set of bearings. They can't withsand much shaft deflection, so when uneven loading is transmitted through to the bearings, seal failure is common. Pumps at the paper manufacturing plant were burning out fast.

Because of the highly corrosive environment associated with the bleaching process, frequent repairs on hard-to-come-by titanium components were continuously more catastrophic. Long lead times for titanium parts combined with a high rate of failure meant replacement parts often required expediting fees, making the failures further costly. This was not a sustainable solution.

THE CHALLENGE

The GPM Service and Repair team set out to find the cause and the solution. The challenge began with determining why the customer was regularly losing seals, bearings and shafts just days after installation. We also needed to find a way to keep the operation functional while pumps and parts were being replaced.

THE SOLUTION

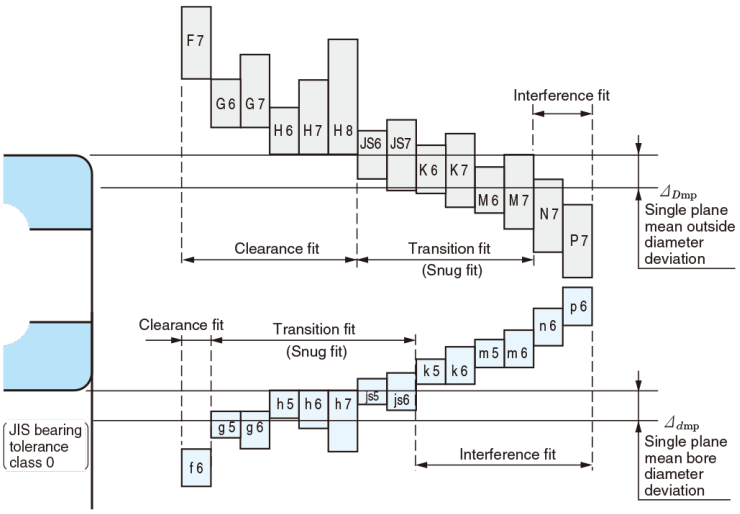

Figure 3: Tolerance & Fit for Shaft and Housing
Photo Courtesy of Koyo Bearings

Back to OEM Specs

Over the years, and due to the ramped-up urgency of completing repairs quickly, the customer was repairing the pumps with the most readily available parts, materials and resources. At the time, it was their only option, so the scope of repairs was understandable. GPM recognized how material changes for the customer and reworking components could lead to shorter turnaround times, but this also contributed to greater problems. GPM advised returning the pump to its OEM state, including the use of OEM specified parts. Getting back to OEM specs was the optimal path forward to increase the Mean Time Between Failures (MTBF).

Adjusting Clearances

The running clearances on an axial flow pump (or any pump) are critical. The tolerances between the propeller outside diameter (OD), elbow inside diameter (ID) and shaft total indicated runout (TIR) bearing fits, were all out of spec, so GPM also advised addressing these clearances as soon as possible.

Due to the complexity of renewing the clearance between the propeller and elbow, the GPM team started at the bearings on the other end of the shaft and worked their way out. The team increased the bearing journal shaft OD by 0.0009" to 0.0017", which increased bearing life significantly. This modification was also conducted on all three rotating assemblies. When the eventual new elbow was installed, this major change out also helped correct several additional factors, including the footing and base mounting of the pump within the system. Another critical clearance adjustment brought back the propeller running clearances to OEM spec, which helped reduce cavitation.

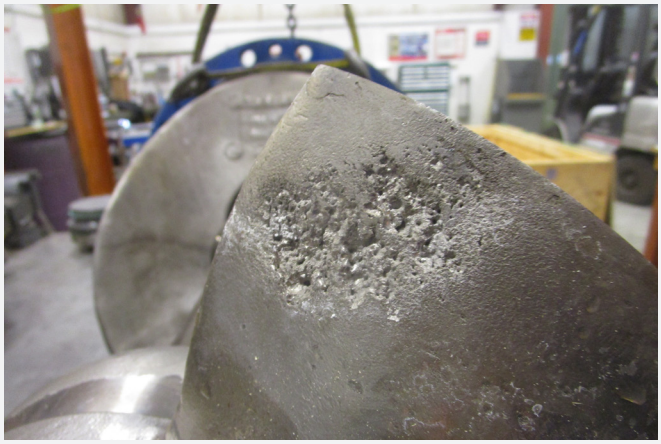

Figure 4: Propeller Cavitation Damage

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