ENGINEERED WEAR COMPONENTS

How a Major Nuclear Plant Saved Millions of Dollars by Cutting Pump Overhauls

Greene Tweed's AR®-HT PEEK bearings improve corrosion resistance and reliability for prolonged use end user specifications.

Challenge

A major nuclear plant site was struggling with several operational challenges involving its service water pumps. The pumps underperformed compared to the factory test curve (as shown in chart 1), experienced high axial down thrust, and endured frequent motor overloads due to low efficiency. Pump degradation resulted in regular, costly repairs. Crevice corrosion in bowl assemblies rendered them irreparable, while packing box leakages caused foundation erosion. Rubber bearings suffered from a much lower than average life and contributed significantly to the overall low Mean-Time-Between Failures (MTBF) of the pump.

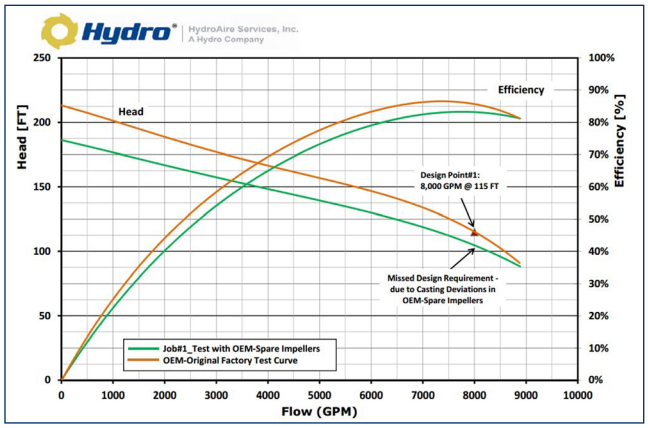
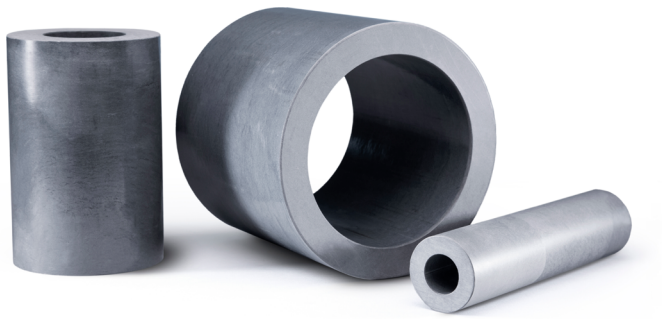


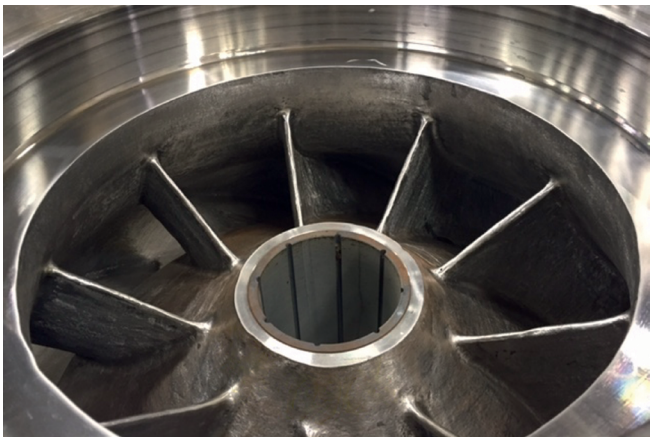
Chart 1: Pumps underperformed



AR-HT – A bearing made of the proprietary thermoplastic material and a stainless steel shaft

Why AR®-HT?

- Designed for high temperature water, crude oil, and abrasive hydrocarbon applications
- Excellent abrasive resistance
- Non-galling/Non-seizing properties
- Excellent vibration dampening
- Lower coefficient of friction



Solution

To address the pump reliability issues, Hydro Inc's HydroAire Nuclear division implemented a holistic redesign of the entire pump system. Key enhancements included a custom hydraulic redesign to meet the stringent duty requirements that provided higher efficiency. An optimized wear ring geometry and high-quality casting were employed for precision and consistency.

To combat corrosion, HydroAire upgraded the pump metallurgy to AL-6XN and implemented high precision tolerancing to ensure proper centerline of all wear components to the centerline of the pump, along with precision balance. To address the issues with bearing failures, they approached Greene Tweed to explore how their AR-HT bearing material could provide improved resistance to wear and dry-run conditions.

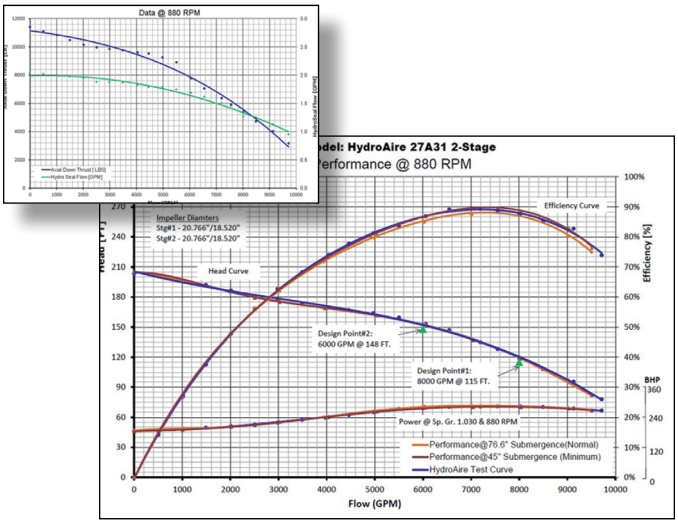
The Result

The nuclear plant saw remarkable improvements after the pump redesign, which included the upgrade to Greene Tweed's AR-HT bearings.

- Elimination of At Least 5 Pump Overhauls, saving over $1.5 million in maintenance costs and preventing potential operational disruptions.
- 3% Efficiency Increase, with the HyroAire's pump curve now aligning closely with the hypothetical curve.
- The integration of Greene Tweed's AR®-HT bearings drastically improved MTBR, addressing abrasive wear reliability concerns.

By addressing both performance and material resilience, the pumps now operate robustly, aligning with the plant's rigorous operational standards and ensuring sustainable, cost-effective performance.

Pump's efficiency increased by over 3% at duty points



"We have not pulled a Hydro Service Water pump to check that the AR-HT remains in good shape. However, vibrations are low and quarterly IST pump performance has been very consistent since we installed the first one in 2017."

Nuclear Plant Engineer

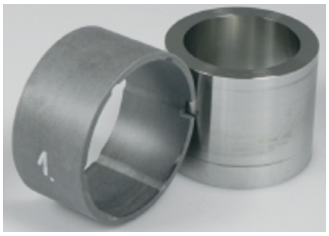
Analysis

Greene Tweed conducted a dry-run test at their state-of-the-art Composite Technology Center in Switzerland. This analysis revealed that AR®-HT bearings provided significant endurance improvement under low or no bearing flush conditions, extending critical alarm to trip time from 2 minutes to 15 minutes, thereby allowing more operational flexibility and reducing immediate risk factors.

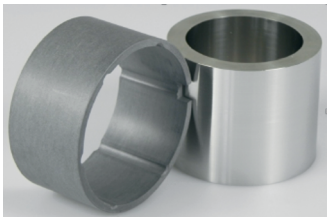
Table 1: The inner diameter of the bearings measured in inches (") and millimeters (mm) before and after testing.

	Before Test	Test 1 (15 min)	Test 2 (30 min)	Test 3 (60 min)
Test Results: 5 psi load	**Inner Diameter**	**Inner Diameter**	**Inner Diameter**	**Inner Diameter**
Bearing 1	2.706" (68.72 mm)	2.706" (68.72 mm)	2.706" (68.72 mm)	2.706" (68.73 mm)
Bearing 2	2.706" (68.72 mm)	2.706" (68.72 mm)	2.706" (68.72 mm)	2.706" (68.72 mm)
Test Results: 10 psi load				
Bearing 3	2.705" (68.70 mm)	2.705" (68.70 mm)	2.705" (68.71 mm)	2.705" (68.71 mm)
Bearing 4	2.706" (68.73 mm)	2.706" (68.73 mm)	2.706" (68.74 mm)	2.706" (68.74 mm)

Journal bearing #1 after third test (105-minute test duration)



Sample 1
and its sleeve
BEFORE
cleaning



Sample 1
and its sleeve
AFTER
cleaning

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