

CASE STUDIES

Mechanical Services

REDU



Side Stream Pump Overhaul & Test

The Challenge

Torishima was tasked with the overhaul for a Side Stream Pump (Model: AZ 250-400) installed in 2002 for one of our clients. This pump had a rated power of 136kW and a pump duty of 1200m³/h generating 30m head and had a purpose of providing cooling water for side stream filtration in a cooling tower system. The customer reported pump failure due to the equipment being submerged in water, following a flood. Upon inspection of the pump, it was found that there was a bearing failure, the non drive end bearing had collapsed, the drive end bearing was excessively worn, and the circlip could not be located. This in turn had created excessive axial movement of the shaft and the impeller had run into the suction wear ring face,

causing 10mm of axial and radial wear on the end suction end of the impeller and internals of the casing. As a result, the shaft had heavy fretting on bearing locations and the shaft shoulder for the bearing was badly damaged.



The Solution

To address these issues, Torishima supplied two new casing wear rings subject to API 610 running clearance to take up the radial gap, thus minimizing the volumetric losses. An 'L-Shaped' impeller wear ring was also supplied, recovering some of the axial wear on the impeller eye and acting as a buffer in preventing future wear in and around the area. Consumable parts such as bearings were replaced, minimizing the vibration. Upon further inspection, it was found that it was the repeated loosening of the lock nut on the end of the shaft that caused the damage to the shaft. To prevent the impeller lock nut loosening in the future, Torishima supplied a newly designed lock nut to fit a propriety

(ISO9001) 'Nord Lock Washer,' creating a wedge effect underneath the bolt head or nut. Torishima tested the unit post overhaul, after renewal of the internal clearances and repair, the verified results found a 6% increase on the efficiency when compared to that of the original test. This highlights the excellent work carried out by the Torishima engineering team and will now reduce the customer's net spend required to operate the pump.



Side Stream Pump Overhaul & Test

Improvements

Improvements provided to this unit as a result of TSSE overhaul & OEM knowledge are as follows:

- New shaft supplied to the OEM standard to replace the existing shaft which was extensively damaged.
- Balance and vibration testing to ensure mechanical integrity of the pump and rotating elements.
- Clean up of the inboard side of the impellers fine annular clearance to a nominal size.
- New wear rings to take up radial gap, minimizing volumetric losses, thus increasing efficiency.

Commercial and Environmental benefits

Torishima continually looks to provide a benefit for our customers through ease of maintenance, improved efficiency or reliability. Torishima always considers the commercial and environmental impact on any overhaul, in this instance:

Increase Efficiency	Monetary savings	CO2 Emission Reduction
6% increase in efficiency when compared to the original "as new" test.	9.78kW/h~£29,129 per year saved whenever the pump is running.	The improvement Torishima provided in efficiency estimates a reduction of over 17,000kg of annual CO2 emissions.

**Estimating 0.2kg of CO2 emissions per KWh of wasted energy.*

Critical Cooling Pump Overhaul & Test

The Challenge

Torishima was tasked with the Overhaul for an Auxiliary Cooling Water Pump (ACWP) for one of our clients. This pump had a rated power of 132.8kW, a pump duty of 780 m³ per hour generating 50.9m head and has a purpose of providing cooling water for a nuclear power station which is critical to the process and helps export electricity to the National Grid.

The pump was taken from site in February 2022 and brought to the TSSE's Glasgow facility where it was then disassembled and inspected by our technical team. It was found during inspection that the rotating element was subject to extensive wear and damage. The unit was also extensively corroded on the internals.

The Solution

The extensively damaged shafts were beyond economical repair, Torishima Service Solutions Europe reverse engineered the new shafts to the OEM standard required where they were fully checked and tested to the Torishima manufacturers standards and tolerances. Consumable parts such as bearings were replaced, the rotor was fully balanced to ISO 1940 standards to minimise vibration at site. Corroded areas were cleaned and checked for residual material thickness to ensure they were within allowable tolerances.

INDUSTRY: POWER

APPLICATION: COOLING WATER

UNIT TYPE: MULTI-STAGE VERTICAL



The pump was internally and externally coated to NORSOK M-501 coating standards and verified using the NACE approvals process to ensure maximum corrosion protection for the unit going forward within the installed environment. TSSE testing the unit post overhaul, after renewal of the internal clearances and repair, the verified results found a 1.5% increase on the efficiency when compared to the of the original test. This highlights the excellent work carried out by TSSE engineering team and will now reduce the customer's net spend required to operate the pump.



Critical Cooling Pump Overhaul & Test

Improvements

Improvements provided to this unit as a result of TSSE overhaul & OEM knowledge were as so:

- New shafts supplied to the OEM standard to replace the existing shafts extensively damaged.
- Improved internal bearing material to reduce clearances, improve efficiencies & reduce co-efficient of friction and wear rates.
- Internal & External coatings to NORSOK M-501 standards to improve corrosion resistance and reduce hydraulic losses.
- Balance and vibration testing to ensure mechanical integrity of the pump and rotating elements.



Commercial and Environmental Benefits

Torishima continually looks to provide a benefit for our customers whether through ease of maintenance, improved efficiency or reliability. Torishima always considers the commercial and environmental impact on any overhaul, in this instance:

Increase in Efficiency	Monetary savings	CO2 Emission Reduction	Reduced Operating Costs
6% increase in efficiency compared to site testing data, 1.5% improvement when compared to the original 'as new' test.	The 9kW/h $\approx$ £3.10 per hour saved whenever the pump is running.	The improvement TSSE provided in efficiency estimates a reduction of over 15,000kg of annual CO2 emissions.	Estimated at £46,487 between every maintenance cycle.

*Estimating 0.2kg of CO2 emissions per KWh of wasted energy,

Land Drainage Pump REDU™ Contract

The Challenge

A total of seven land drainage pumps, originally installed in the 1960s and 70s, were overdue major inspection and maintenance works. TSSE were awarded the contract to carry out the inspections and any necessary repairs on four identical 36" pumps and three smaller 24" units at two separate pumping stations. It had been several years since the last intervention on any of the pumps and no record existed of the previous as found condition. Upon inspection of one of each set of pumps it was found that significant rework and modernising was required. This would require the manufacture of spare parts and redesigning of several components, including the shaft coupling arrangement & replacing an obsolete thrust bearing.

INDUSTRY: WATER

APPLICATION: LAND DRAINAGE



The Solution

Within our strip-down report, we included our design and overhaul recommendations to improve pump performance and reduce operating expenditure. We also provided a full set of engineering drawings, allowing the customer faster access to improved spare parts which meet the requirements of the new pump profile.

Upon inspection, it was found the impeller keys had deformed due to excessive keyway loads during operation. TSSE re-sized the keyways and optimised material selection to prevent this from happening in the future.

TSSE provided a hard faced HVOF upgrade to the shaft to prevent future galling. All wear rings were re-engineered to maximise the efficiency of the unit. The rotor was balanced to meet ISO 1940 standards, and the rebuild was completed on time to meet site operational requirements.



Land Drainage Pump REDU™ Contract

Improvements

Improvements provided to this unit as a result of TSSEs overhaul & OEM knowledge were as so:

- The shaft ends were machined down to accommodate for the new Sleeves designed to fit onto the shaft.
- The shaft end and shaft bottom bush were then coated with a "DIATEC 1086" HVOF metal coating in order to improve upon the surface hardness of the shaft and decrease overall wear on the shaft.
- The Thrust bearing insert ring was fitted onto the thrust bearing housing in order to accommodate for the improved thrust bearing design.



Commercial and Environmental Benefits

Torishima continually looks to provide a benefit for our customers whether through ease of maintenance, improved efficiency or reliability. Torishima always considers the commercial and environmental impact on any overhaul, in this instance:

Increase in Efficiency	Monetary Savings	CO2 Emission Reduction	Reduced Operating Costs
TSSE manage to improve upon this pump toward a 4% increase in the efficiency compared to its efficiency before the overhaul.	8 kW/h saved ≈ £2.54 saved every hour the pump is running.	The improvement TSSE provided in efficiency estimates a reduction of over 18,000kg of Co2 emissions per year.	Savings approximating £35,356 between every maintenance cycle for the client

*Estimating 0.2kg of CO2 emissions per KWh of wasted energy,

REDU of Boiler Feed Pump for Power Station

The Challenge

TSSE were tasked with the overhaul of a problematic Boiler Feed Pump at a UK Power station in Northern Ireland. The customer had reported running problems with the pump and a difficulty in sourcing spare parts.

Upon receipt of the pump, TSSE performed all our routine strip-down and checks, providing a report back to site within 5 working days as standard. It was found the shaft run-out was out of tolerance, as well as being scarred, ovalled and undersized along the main body. All wear rings were also found to be out of tolerance to OEM classifications

INDUSTRY: POWER GENERATION

APPLICATION: BOILER FEED PUMP

UNIT TYPE: MULTISTAGE - 3X10
WXH 14 STAGE



The Solution

Within our stripdown report, we included our design and overhaul recommendations to improve pump performance and reduce operating expenditure. We also offered to create a full set of engineering drawings allowing the customer faster access to improved spare parts which meet the requirements of the new pump profile, an option which was duly taken.

Upon inspection, it was found the impeller keys had warped due to excessive torquing during operation. TSSE upgraded the keyway dimensions and optimised material selection to prevent this from happening in the future. To design out the scoring and undersizing on the shaft, the main body was oversprayed with an HVOF coating before final machining. All wear rings were re-engineered to optimise the efficiency of the unit. The rotor was balanced to meet ISO standards, and the rebuild was completed on time to meet site operational requirements.



Land Drainage Pump REDU™ Contract

Improvements

Improvements provided to this unit as a result of TSSEs overhaul & OEM knowledge were as so:

- Shaft was modified to reduce eccentricity within the casing. It was then coated with "DIATEC 1086" HVOF ceramic coating in order to reclaim the component fits and improve surface hardness to reduce wear.
- Manufactured a new balance drum to suit the new shaft changes and amend the improve the pumps thrust capability and efficiency.
- Impeller bores were re-machined to achieve concentricity tolerances with the shaft and improve the rotodynamic stability.
- Impeller wear rings modified to suit changes in impeller bore dimensions, whilst also reducing volumetric losses while in operation.
- New diffuser and casing wear rings were then manufactured to suit the new OEM dimensional changes and clearances.



Commercial and Environmental Benefits

Torishima continually looks to provide a benefit for our customers whether through ease of maintenance, improved efficiency or reliability. Torishima always considers the commercial and environmental impact on any overhaul, in this instance:

Increase in Efficiency	Monetary Savings	CO2 Emission Reduction	Reduced Operating Costs
5% efficiency upgrade on the unit compared to the efficiency value prior to the overhaul, this was through reduction & volumetric losses.	23.75kW/h $\approx$ £7.55 saved every hour the pump is running based on current energy costs. ($\approx$ £44,000 per year)	The improvement TSSE provided in efficiency estimates a reduction of over 31,000kg of Co2 emissions per year*.	Saving an estimated £220,000 between typical five-year maintenance cycles.

*Estimating 0.2kg of CO2 emissions per KWh of wasted energy,

Conclusion

This case highlights Torishima's ability to address complex challenges through a rigorous, innovative, and customer-focused approach. Our team combines technical expertise with an unwavering commitment to sustainability and efficiency, delivering solutions that exceed both commercial and environmental expectations.

For projects involving mechanical systems, overhauls, and maintenance services, **Torishima Europe's Mechanical Service – REDU** Division is available to provide advice, technical support, and further information.

At Torishima, we transform challenges into successes.



Driving Industrial Evolution

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