

HYDRO TURBINE GEARBOX (IPP SOUTH - INDIA)



1 TECHNICAL DATA:

Power	5.85 MW
Type	Speed Reducer
Input / Output Speed	159.3 / 750 rpm
Application	Generator
Make	German
Year of Commissioning	2012

2 PREAMBLE / PROBLEM REPORTED

Frequent failures of gear teeth were reported in the hydro turbine gearbox, leading to repeated shutdowns and reduced reliability of the generating unit. Despite multiple corrective interventions, the issue persisted, significantly impacting plant availability and performance.

3 DIAGNOSTICS STEPS UNDERTAKEN / OBSERVATIONS MADE

Detailed operating assessment and inspection revealed the following:

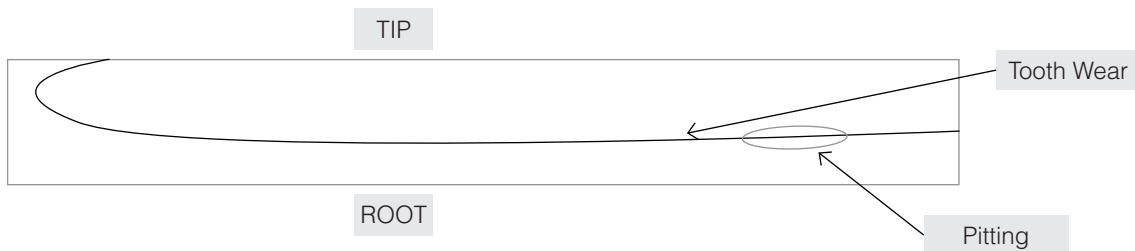
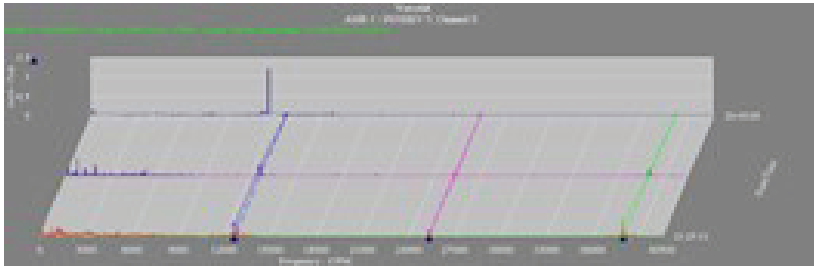
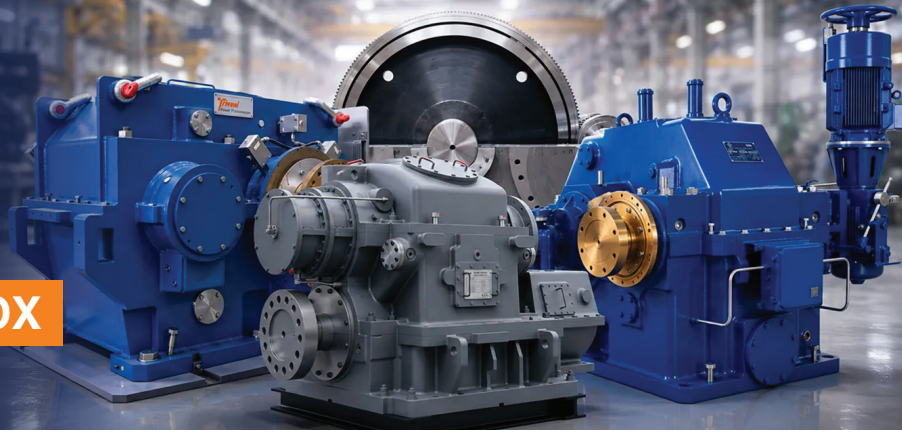
- Turbine and gearbox shaft axes were found to tilt under load conditions by 0.1mm
- End loading observed on gear teeth, indicating uneven load distribution
- Localized tooth damage and pitting observed across the gear profile
- Maintenance history confirmed repetitive gear failures despite prior corrective actions



4 ANALYSIS

- The root cause was identified as gear misalignment during load operation, driven by turbine rotor pull. This was causing harmonics of GMF to dominate under higher load conditions.
- Load-induced shaft deflection resulted in uneven contact across the gear face width
- This caused localized stress concentration, leading to progressive tooth wear, pitting, and repeated gear failures
- The existing horizontal gearbox configuration proved inadequate to accommodate shaft displacement under load

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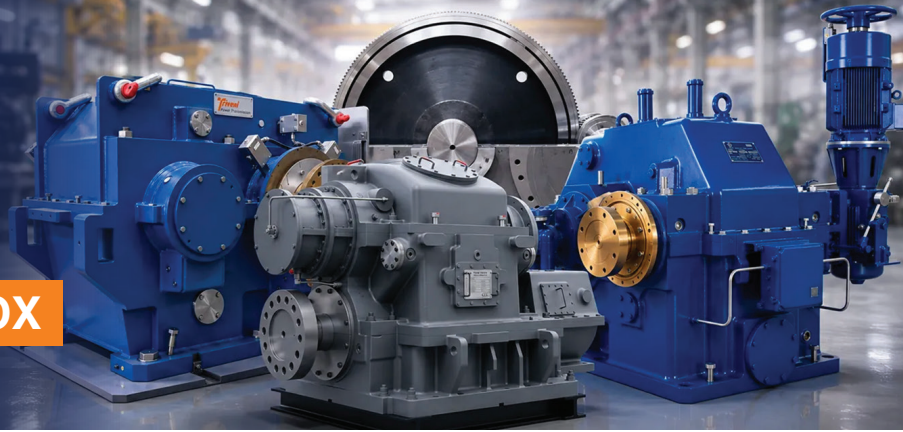
5 SOLUTION OFFERED / ACTION TAKEN

Triveni implemented an engineering redesign to address the root cause:

- Changed gearbox configuration from horizontal to vertical offset design
- The vertical offset arrangement ensured tooth load contact stability under turbine load conditions, minimizing the impact of shaft deflection
- Designed and supplied new vertical offset gearboxes to replace the existing units
- Successfully implemented across all 10 gearboxes at the plant
- Post-commissioning hard blue checks confirmed greater than 90% uniform gear contact



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6 CONCLUSION

The gearbox system was successfully upgraded and recommissioned, restoring reliable operation.

The implemented solution ensured:

- Elimination of repetitive gear tooth failures due to turbine shaft deflection.
- Improved load distribution and alignment under operating conditions
- Enhanced gearbox reliability through optimized configuration design
- Stable performance with all parameters within permissible limits

7 OUTCOME

All units have been operating reliably since upgrade, with consistent performance and improved operational stability. The complete solution was delivered within 24 weeks, ensuring minimal downtime.