



STEAM TURBINE GEARBOX (IPP– PHILIPPINES)

1 TECHNICAL DATA:

Power	12,457 kW
Type	Speed Reducer
Input/Output Speed	6500 / 1500 RPM
Ratio	1: 3.61
Driving Equipment	Steam Turbine
Driven Equipment	Alternator
Make	European
Year of Commissioning	2016

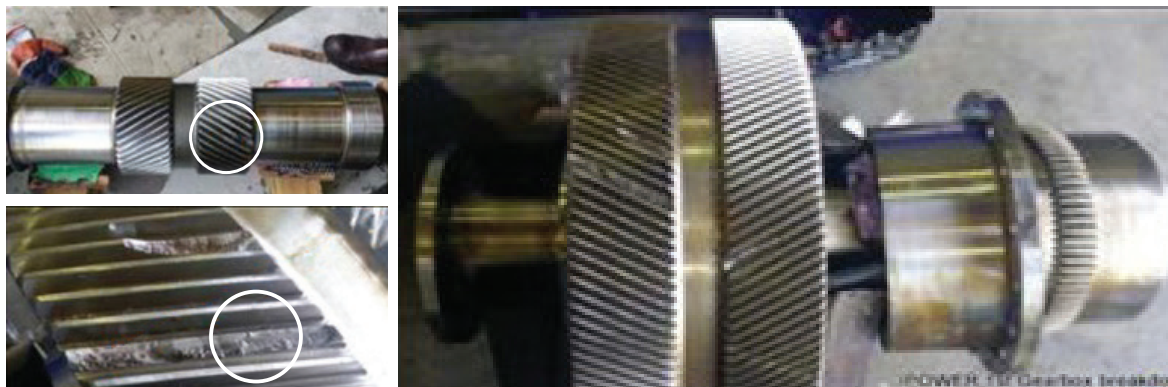
2 PREAMBLE / PROBLEM REPORTED

Within 10 months of commissioning, the gearbox began exhibiting abnormal noise and recurring gear failures. Despite replacement of the gear internals by the OEM, similar failures reoccurred within a short period, indicating a persistent and underlying design issue affecting reliability.

3 DIAGNOSTICS STEPS UNDERTAKEN / OBSERVATIONS MADE

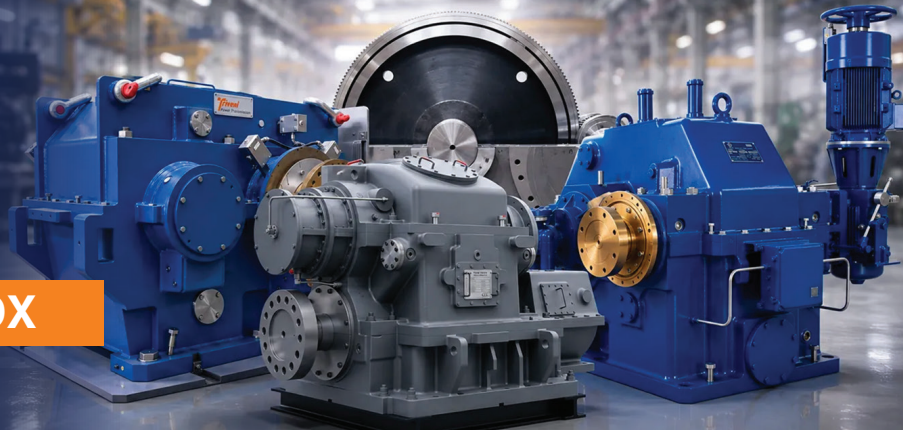
Comprehensive technical evaluation was conducted to determine the root cause:

- Tooth failures were observed on both pinion and gear teeth.
- Shaft vibration and bearing temperatures remained within acceptable limits until the onset of abnormal noise.
- Maintenance records revealed consistent failure patterns across both original and replacement gear sets.
- Detailed dimensional inspection and design validation of gear internals and bearings were carried out.



Tooth Failure noticed on both in pinion and gear tooth

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4 ANALYSIS:

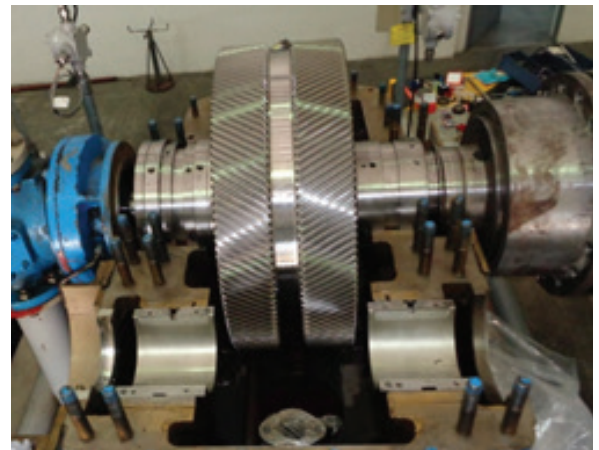
The identical failure pattern confirmed a systematic design limitation

- Tooth uprooting indicated insufficient load-carrying capacity under operating conditions
- The gearbox was operating with a service factor of 1.1, significantly below recommended industry standards
- The system was exposed to transient loads due to grid disturbances and short-circuit conditions, which were not adequately accounted for in the original design
- These transient conditions led to localized overloading and repeated gear failures
- This led to localized overloading and recurring tooth failures in the pinion

5 SOLUTION OFFERED / ACTION TAKEN:

Triveni implemented a comprehensive redesign to enhance performance and reliability:

- Designed a new gearbox with an increased service factor of 1.4, aligned with international standards
- Gear module increased to improve tooth strength and fatigue resistance
- Introduced pressure dam bearings to improve performance under no-load and partial-load conditions and to suppress sub-synchronous vibrations during transient events



6 CONCLUSION:

The redesigned gearbox was successfully manufactured, supplied, and commissioned within 18 weeks.

The implemented solution ensured:

- Elimination of recurring gear failures
- Improved load-handling capability under transient conditions
- Compliance with industry standards
- Stable and reliable gearbox performance

7 OUTCOME:

The gearbox has been operating reliably since commissioning, delivering consistent performance under varying load conditions.