

STEAM TURBINE GEARBOX (CEMENT –WEST, INDIA)



1 TECHNICAL DATA:

Power	25 MW
Type	Speed Reducer
Input / Output Speed	6278 / 1500 rpm
Application	Steam Turbine Generator
Make	German
Year of Commissioning	2002

2 PREAMBLE / PROBLEM REPORTED

Premature gear failure was reported in the steam turbine generator (STG) gearbox at a cement plant, leading to repeated shutdowns and reduced reliability.

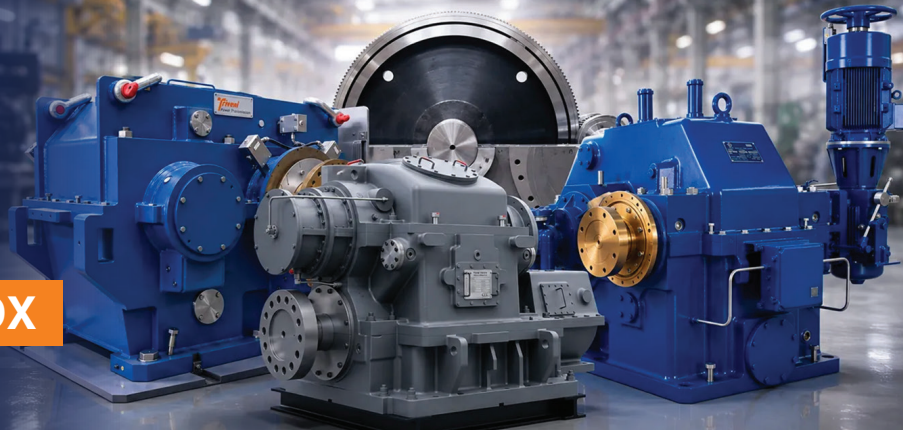
Despite replacement of the gear set by the OEM, pitting reoccurred within one year, indicating an underlying design limitation. The unit was operating in island mode (home load), where reliability is critical for continuous plant operation.

3 DIAGNOSTICS STEPS UNDERTAKEN / OBSERVATIONS MADE

A detailed technical evaluation and review of operational history identified the following:

- Severe pitting observed on the pinion shaft gear teeth
- OEM-supplied replacement gear also exhibited premature failure within a short duration
- The STG was operating in island mode, exposing the system to higher transient loads
- Maintenance records confirmed repetitive gear damage despite prior corrective interventions





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4 ANALYSIS

- The root cause was identified as inadequate consideration of transient operating conditions during the original gearbox design
- Operation in island mode introduced frequent load fluctuations and short-circuit torque conditions, significantly increasing stress on gear teeth
- These transient loads were not sufficiently accounted for in the OEM design, leading to premature pitting and repeated failures
- The mismatch between operating conditions and design limits resulted in reduced gear life and reliability

5 SOLUTION OFFERED / ACTION TAKEN

Triveni implemented a comprehensive redesign to address the root cause and enhance gearbox performance:

- Performed detailed design analysis incorporating island mode operating conditions
- Factored in short-circuit torque and grid/load fluctuations into gear design calculations
- Developed and manufactured new gear internals with improved material properties and optimized geometry to withstand transient stresses
- Ensured compatibility with existing gearbox configuration while enhancing durability
- Alignment was revalidated to ensure proper shaft positioning and coupling behaviour



6 CONCLUSION

The gearbox was successfully refurbished and recommissioned, restoring reliable operation. The implemented solution ensured:

- Elimination of premature gear failures
- Improved reliability under island mode operation and transient loading conditions
- A robust design accounting for real operating scenarios
- Stable operation with all parameters within permissible limits

7 OUTCOME

The gearbox has been operating reliably since recommissioning, with enhanced durability and consistent performance. The complete solution was delivered within 24 weeks, ensuring minimal disruption to plant operations.