



COMPRESSOR GEARBOX (FERTILIZER SOUTH – INDIA)

1 TECHNICAL DATA:

Power	Motor – 1150 kW + GRT – 590 kW
Type	Integrally Geared Air Compressor
Input Speed	1485 RPM
Output Speeds	15,783 / 19,049 RPM
Ratio	10.628 / 12.827
Driving Equipment	Motor + Gas Recovery Turbine (GRT)
Driven Equipment	Compressor
Make	Seisa
Year of Commissioning	1991

2 PREAMBLE / PROBLEM REPORTED

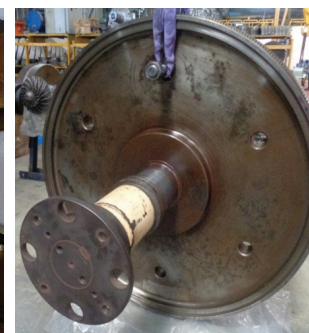
During 2015, the unit experienced multiple failures, including bull gear tooth fractures, tilting pad bearing failures, and air seal damage, leading to a complete shutdown of the fertilizer plant.

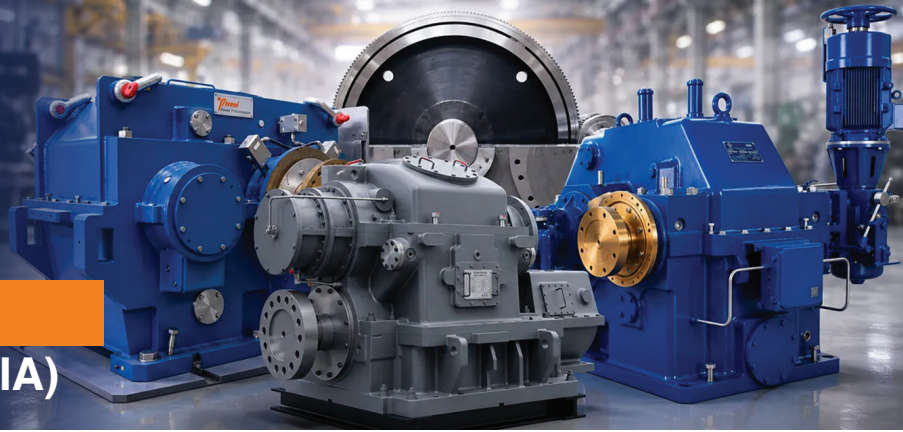
The critical nature of the failure required a comprehensive engineering intervention to restore reliability and ensure sustained operation.

3 DIAGNOSTICS STEPS UNDERTAKEN / OBSERVATIONS MADE

Detailed inspection and technical evaluation revealed the following:

- Multiple tooth fractures on the bull gear wheel, indicating severe mechanical distress.
- Failure of tilting pad bearings and air seals.
- Historical vibration analysis showed the presence of 1X GRT stage frequency across all shafts, indicating system-wide dynamic influence.
- Maintenance records confirmed repetitive failures in the GRT stage pinion and associated bearings.
- Critical bearing pad dimensions were captured using precision measurement techniques (CMM).

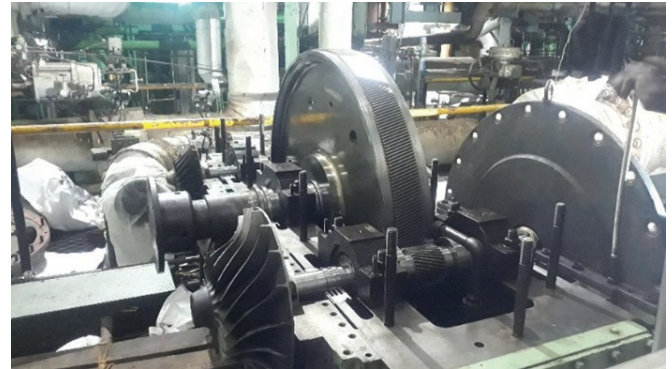




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4 ANALYSIS:

- The primary root cause was identified as fatigue failure of the bull gear and bearings
- Uneven clearance in the GRT stage volute casing contributed to vibration amplification and cyclic loading
- Existing air seal and bearing designs were inadequate for handling operational stresses and required redesign
- The combined effect of vibration, clearance variation, and design limitations led to progressive damage and eventual system failure



5 SOLUTION OFFERED / ACTION TAKEN:

Triveni implemented a comprehensive engineering solution to restore performance and reliability:

- Designed and manufactured a new gear set using case-hardened material, significantly improving durability and fatigue resistance
- Derived optimized interference values for impeller fitment, considering stage-wise power transmission and centrifugal expansion effects
- Developed new tilting pad bearings with improved design, allowing ease of pad replacement in case of future wear or failure
- Performed reverse engineering of shaft sleeves and air seals, ensuring proper fitment and enhanced sealing performance
- Assembled the upgraded gear set and bearings within the existing gearbox casing



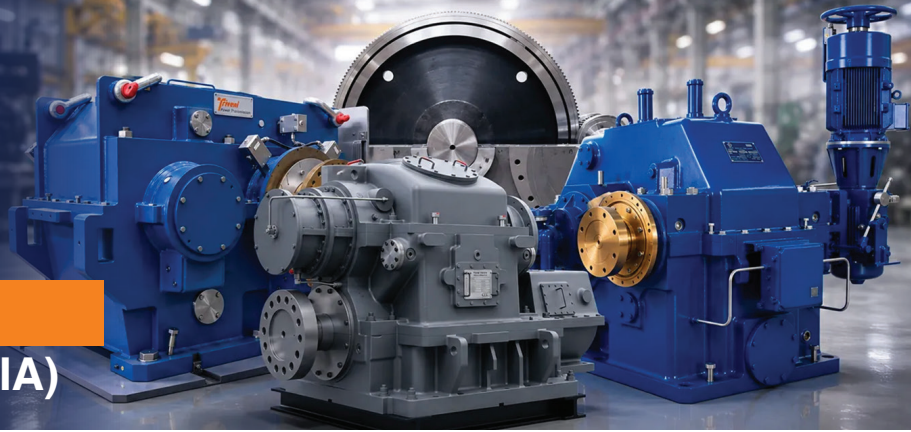
6 CONCLUSION:

The gearbox was successfully refurbished and recommissioned in June 2016, restoring full plant operation.

The implemented solution ensured:

- Elimination of bull gear and bearing failures
- Improved reliability through case-hardened gear design and optimized bearing configuration
- Stable operation with properly defined interference fits and clearances
- All gearbox parameters within acceptable limits during trial and operation

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7 OUTCOME:

The gearbox has been operating reliably since recommissioning, delivering sustained performance under demanding operating conditions.