



ASIA TURBOMACHINERY & PUMP SYMPOSIUM
SINGAPORE | 22 - 25 FEBRUARY 2016
M A R I N A B A Y S A N D S



BVL Power Systems

Abrupt Stoppage of Turbine Rotor, running on Barring after Major Overhauling

Presented by

Ravi Reddy, BVL Power Systems

Authors

RANGA REDDY : Executive President

Mr Ranga Reddy is a Mechanical Engineer and has worked in BHEL, a Government of India Company for about 40 years. His expertise lies in Marketing & Sales, Project Monitoring, Project Engineering, Contract Management & Procurement, Erection & Commissioning, Supply of Spares and After Sales Service of Complete Power Plant Equipment. Specialization being in Captive Power Plants of Industrial Turbo-Sets, Compressors and Drives for all Industrial applications.

RAVI REDDY : General Manager

Mr Ravi is a Mechanical Engineer and a Masters Degree in Business Administration. Has 15 years experience in Project Management, Planning and Operations. He was involved in execution of various Turbo Generator capacities ranging from 5MW to 80MW and Turbo Compressor sets of different makes in India and abroad. He is also well versed with related software technologies. His Planning and Project Management skills helped in completing the projects well within time successfully.

Abstract

This case study is about a typical experience where a steam turbine, which was running at 100 RPM on barring (turning) after overhaul, stopped abruptly and the rotor was found to be seized.

The case study is about this incident and the external factors influencing the turbine rotor seizure, from 100 RPM to zero RPM in less than 5 seconds, its root cause and the rectification activities.

Table of Contents

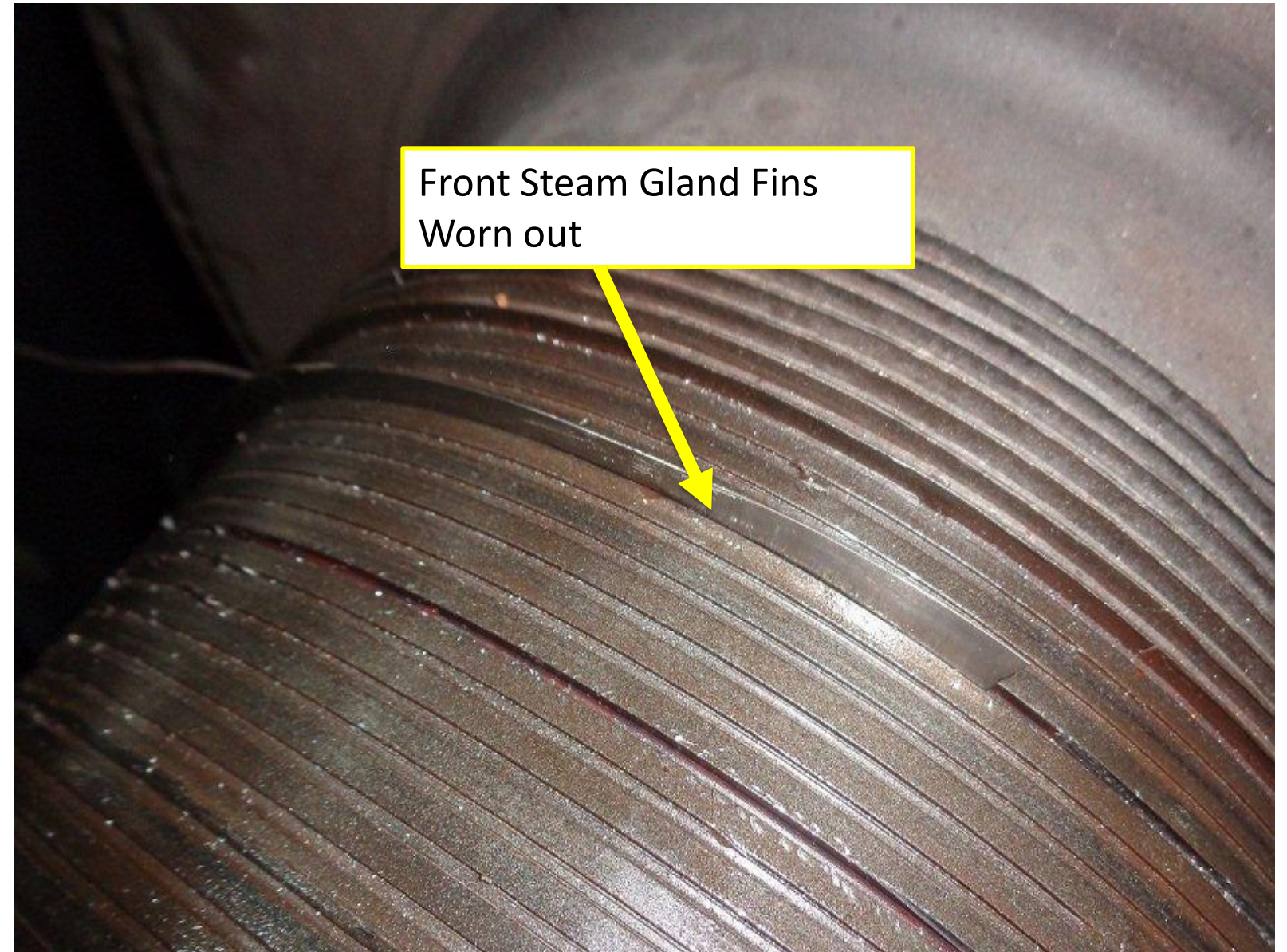
- Background
- Observation
- Investigation
- Root Cause
- Corrective Actions
- Key Lessons Learned
- Conclusion

Background

- Major Overhaul carried out on 25 MW Turbo Generator Set
- Unit started and reached rated speed of 3000 rpm
- Turbine tripped due to high vibrations on Front Journal Bearing
- Turbine rotor running on barring gear stops abruptly

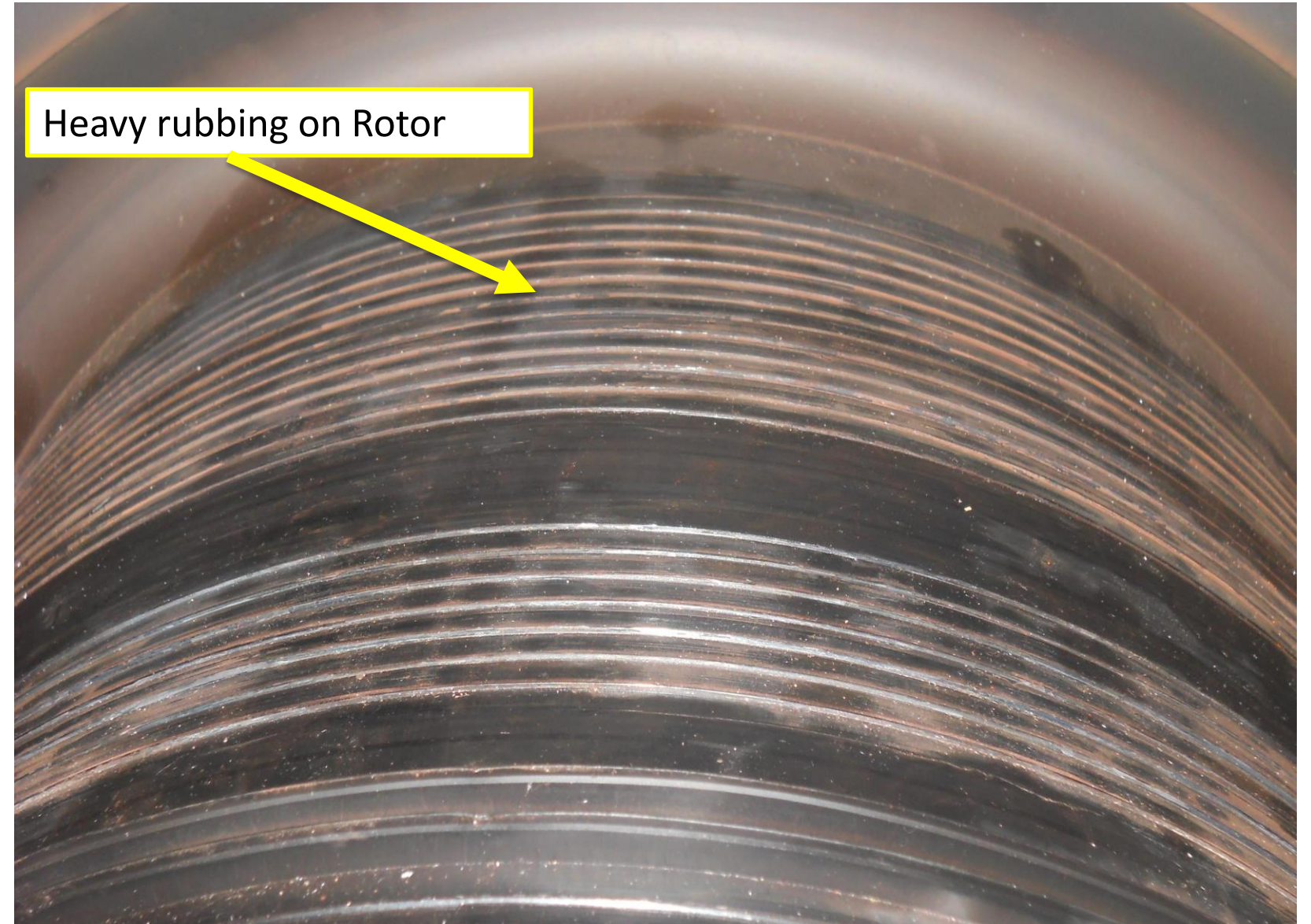
Observations

- Turbine Rotor running on barring gear stops abruptly
- Turbine Rotor did not rotate with Hand Barring System.
- Rotor rotates freely again on hand barring after 30Hrs of stoppage.



Observations

On opening the casing, heavy rubbing noticed on Front Steam Gland and rotor found to be touching the Steam Glands.



Investigation

▪ Log Sheet Parameters checked and found that the Turbine tripped on High Front Journal Bearing Vibrations.

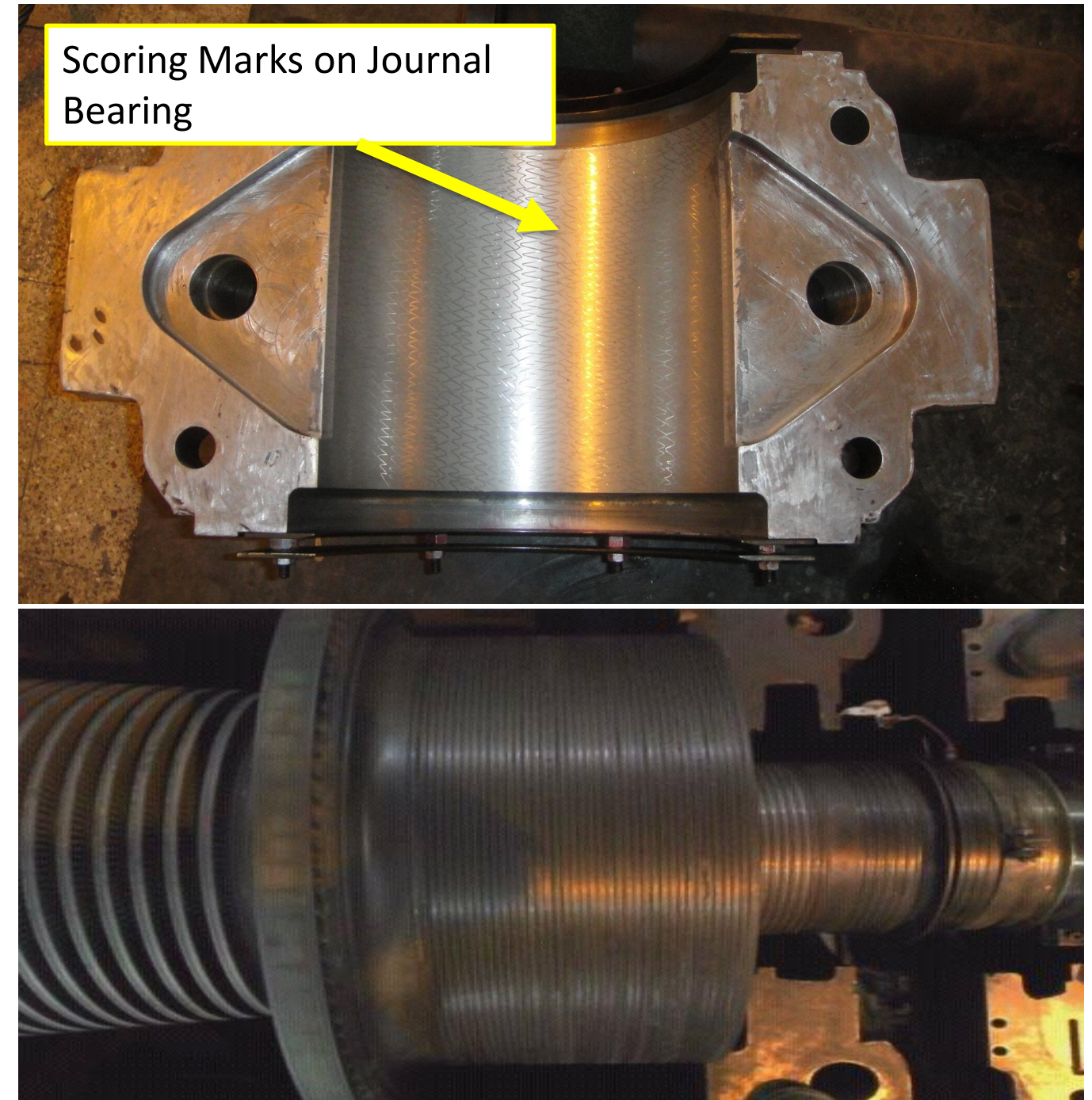
▪ Turbine Rotor Centering checked and found to be OK

▪ Turbine Rotor Setting dimensions were checked and found to be as per design values.



Investigation

- Bearings were checked and found slight scoring marks.
- Axial clearances between Barring Gear Wheel and Nozzle block was checked and found to be OK.
- Oil flows to all bearings and Barring gear inlet nozzles were checked.

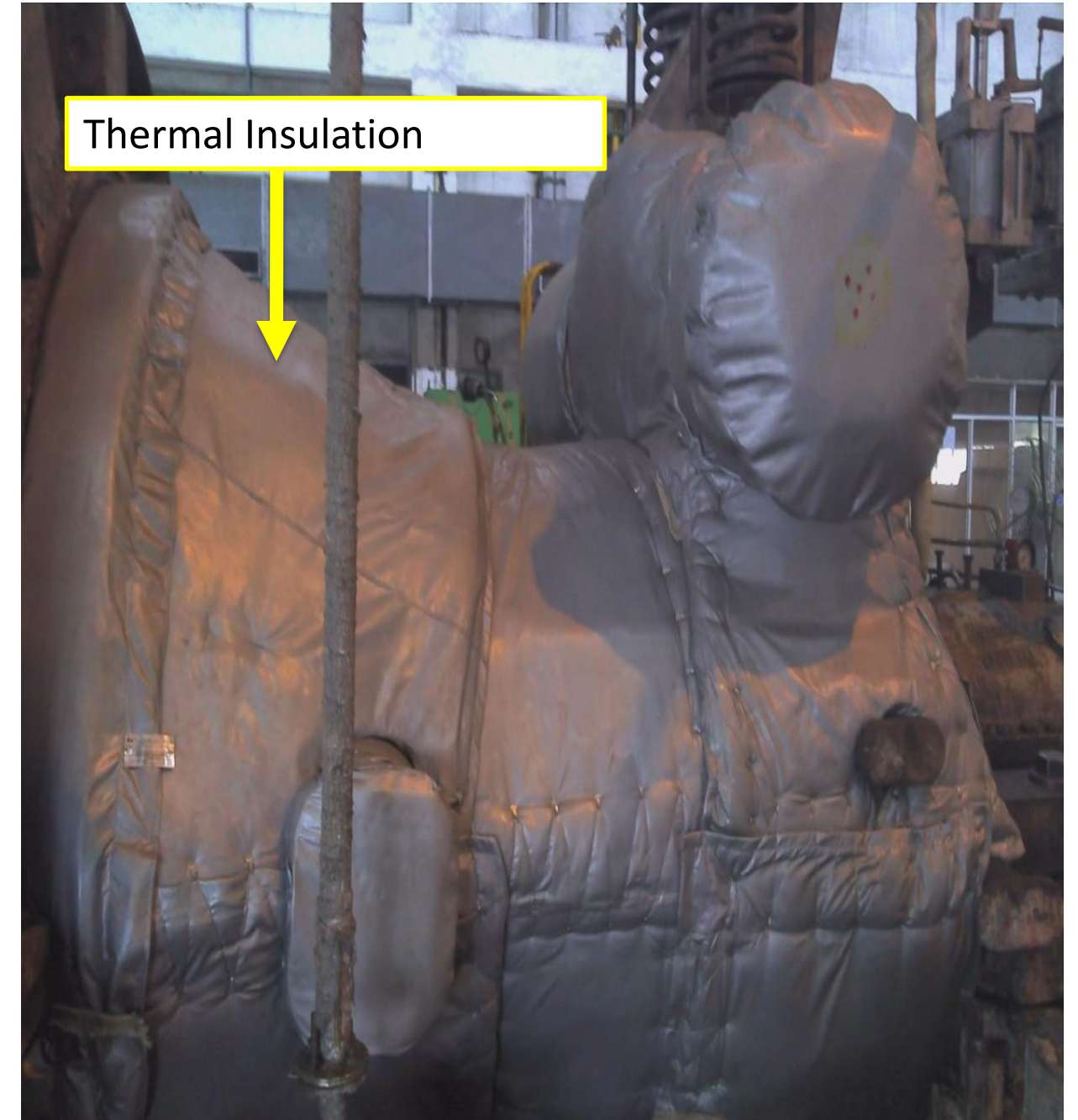


Investigation

- Turbine Casing Temperatures were measured. Found that the temperature of the bottom casing was 317°C and the temperature of the Top casing was 237°C.
- Turbine Casing Insulation skin temperature on the top side was 135°C and on the bottom side was 55°C.

Root Cause

The root cause was very typical. After the turbine major overhaul its thermal insulation was not replaced as per the OEM design and recommendations. The thermal insulation was installed properly, as per recommendation, on bottom casing but the top casing's thermal insulation was not installed to the correct thickness, i.e. less than recommended.



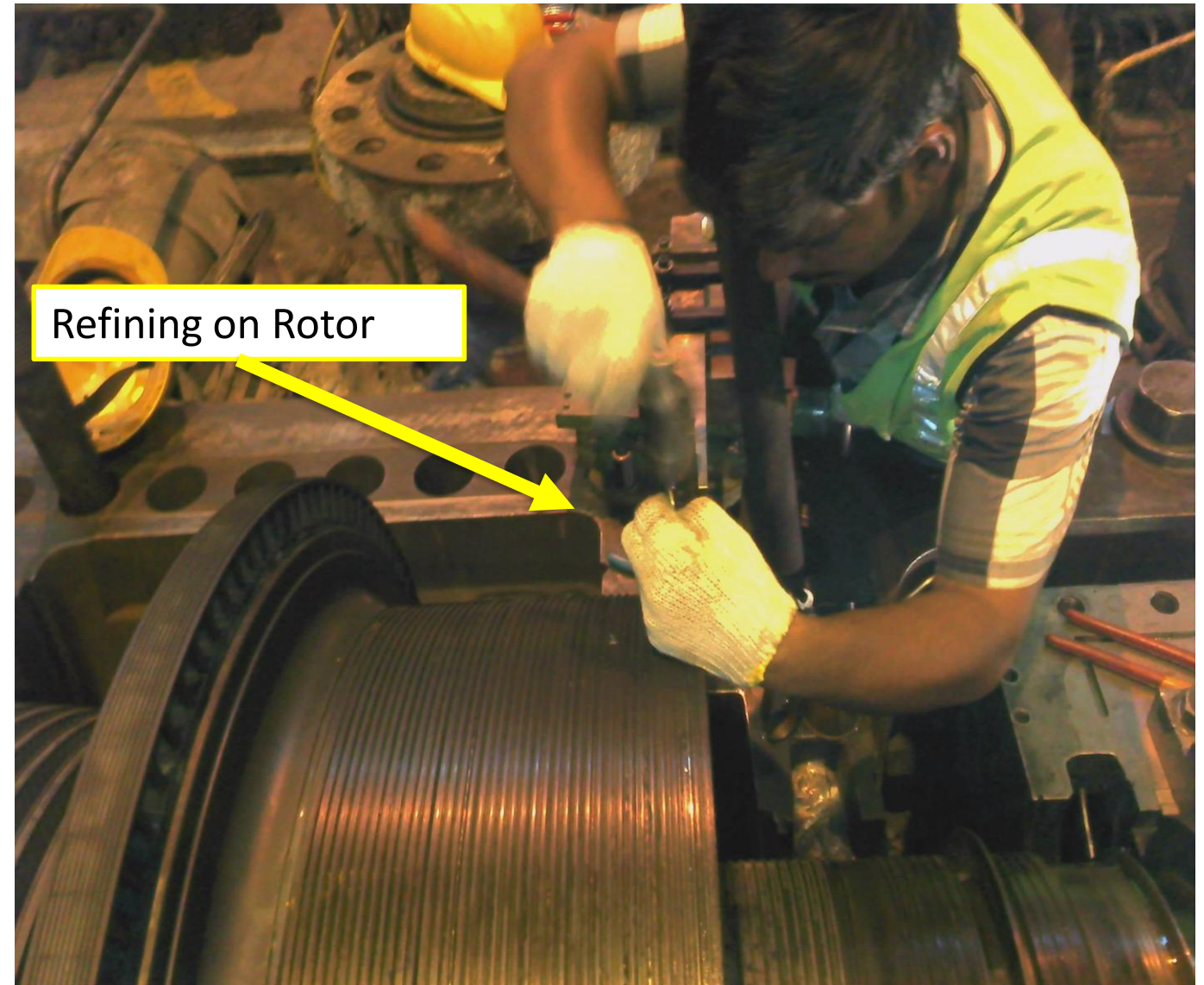
Root Cause

As per design the thermal insulation thickness on the casing (top and bottom) should have been 10-12" whereas only 5-6" was reinstated at the top. This resulted in a temperature differential between the top and bottom casings of 80°C, whereas the allowable limit is 25°C.

Therefore, due to uneven thermal expansion of the top casing and the bottom casing, the rotor rubbed against the static casing internals (mainly the steam glands), and led to the seizure of the rotor.

Corrective Actions

- Turbine rotor and stator parts repaired
- Insulation installed per the specification
- Turbine restarted without further issues



Recommendations

- Turbine Casing thermal insulation thickness should be 10"-12" on the entire casing surface.
- Proper Insulation material to be used.
- Plaster of Paris to be done on Turbine casing thermal insulation



Key Lessons Learned

- Inadequately installed turbine casing thermal insulation can cause a serious incident like rotor seizure.
- Turbine thermal insulation should be maintained as per specification.
- Turbine thermal insulation should be a major item in the major overhauling & safe maintenance procedure check list .
- Uneven temperature of turbine casing due to inadequately installed insulation can cause damage to the turbine rotor and casing internals (involving long down time & cost)