

Protecting Magnetic Bearings from External Factors and Process Contaminations

(Case Study)

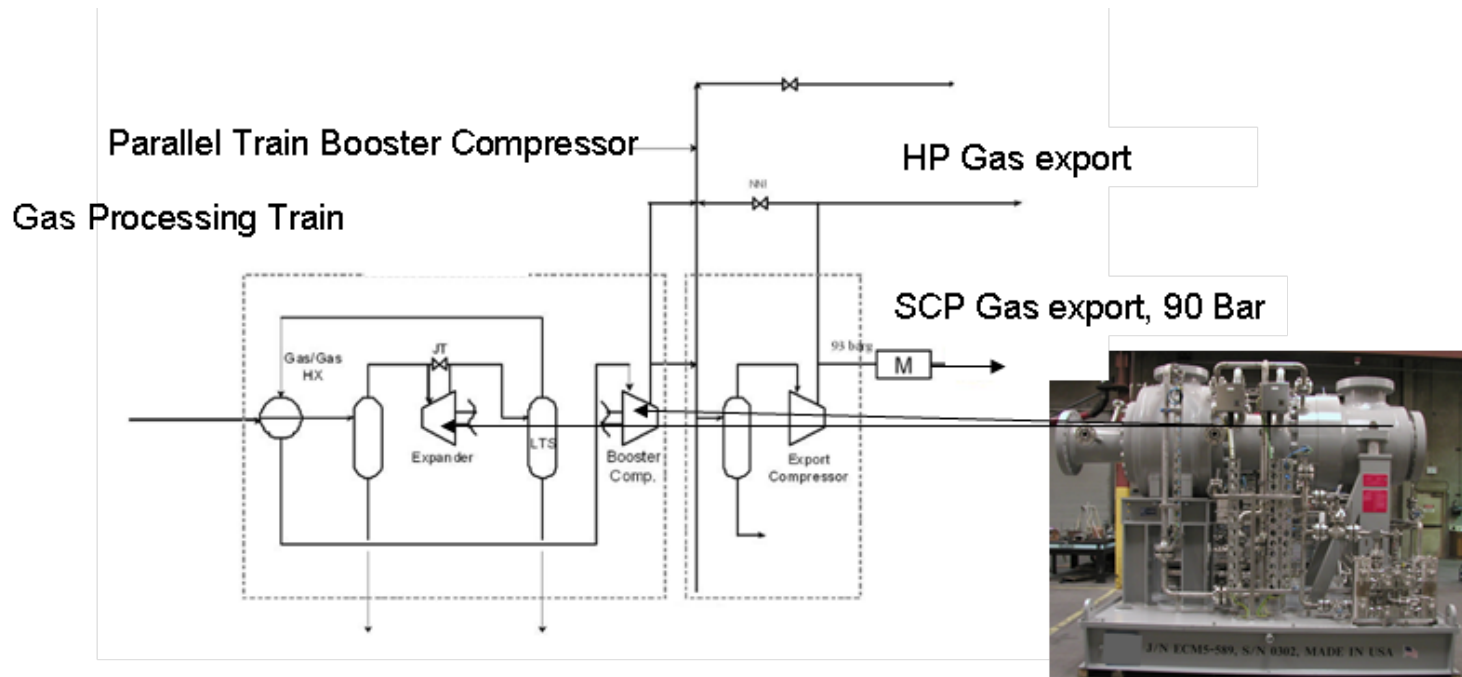
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Shah Deniz Magnetic Bearing Turboexpander – Compressor Units

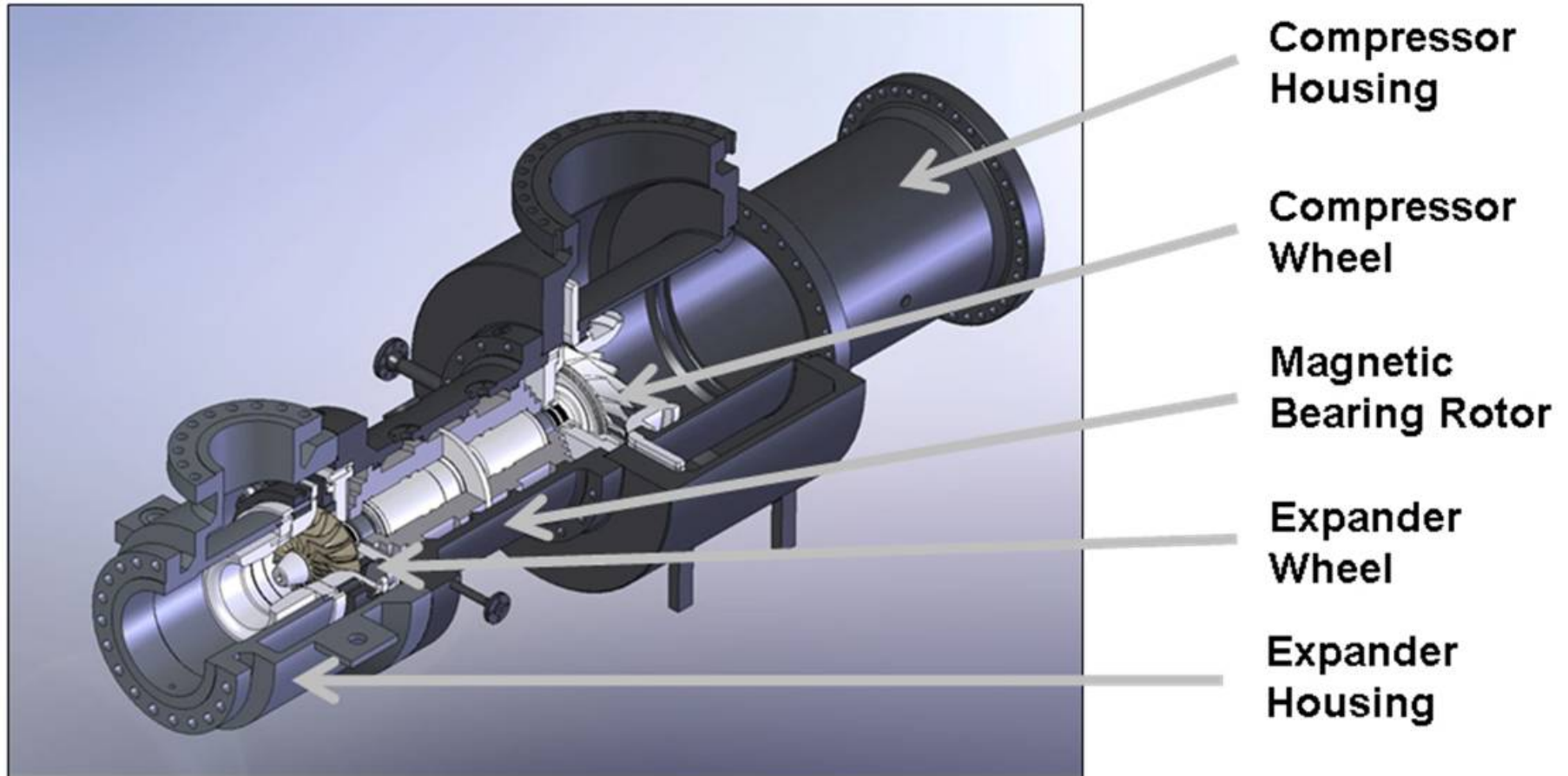
- Shah Deniz is one of the largest turboexpander gas processing plants in the world (900MMSCFD pipeline dew point control).
- Several failures due to external factors / process contamination was affecting magnetic bearing sensors, hence the AMB control system.



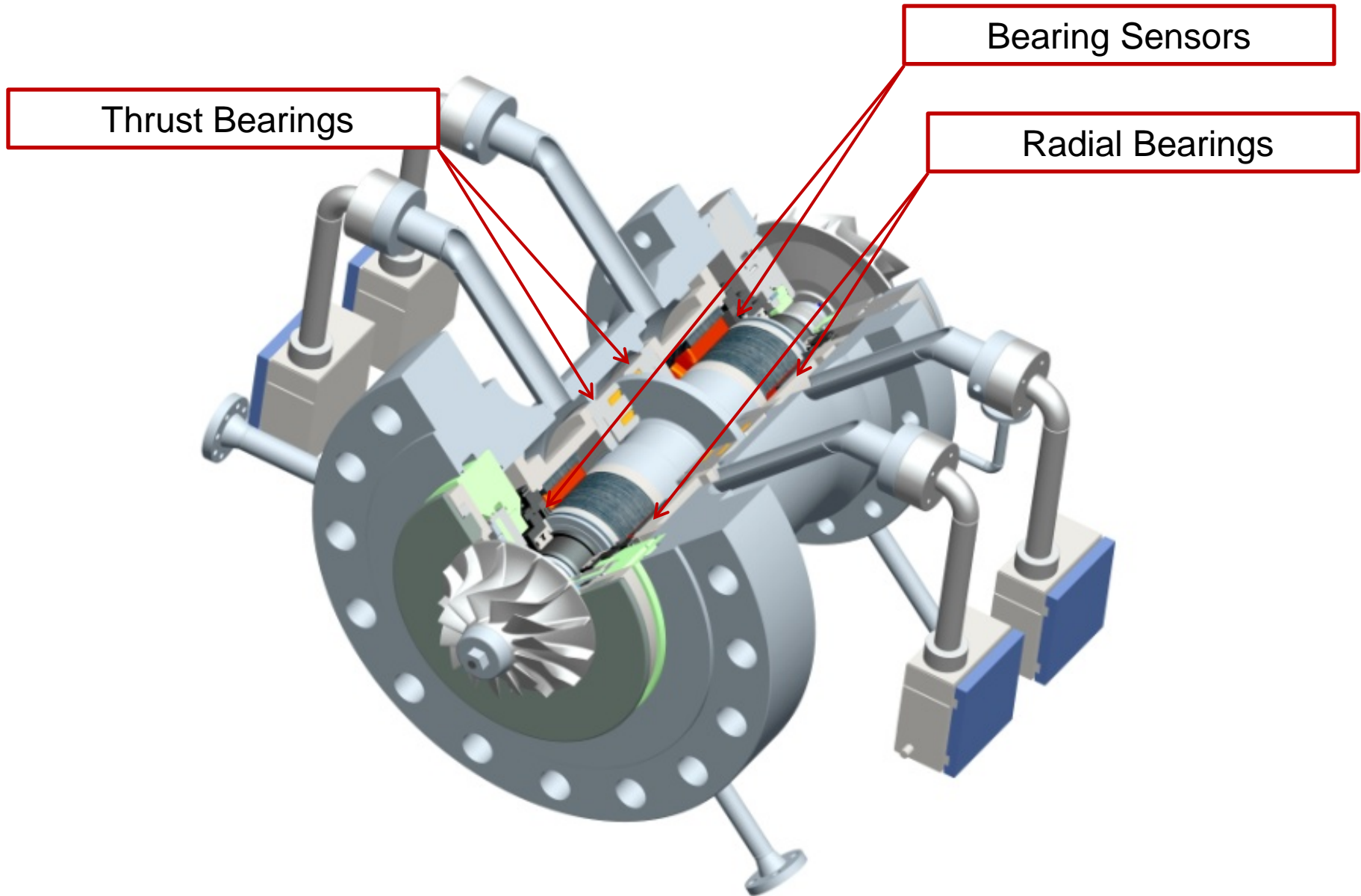
Shah Deniz Magnetic Bearing Turboexpander – Compressor Units

- Each Turboexpander train is rated for 9 MW (12,000 HP)
- Expanding the process gas from 105 bar to 60 bar (1520 to 875 PSI)
- Glycol (MEG) is injected at turboexpander inlet to inhibit Hydrate formation

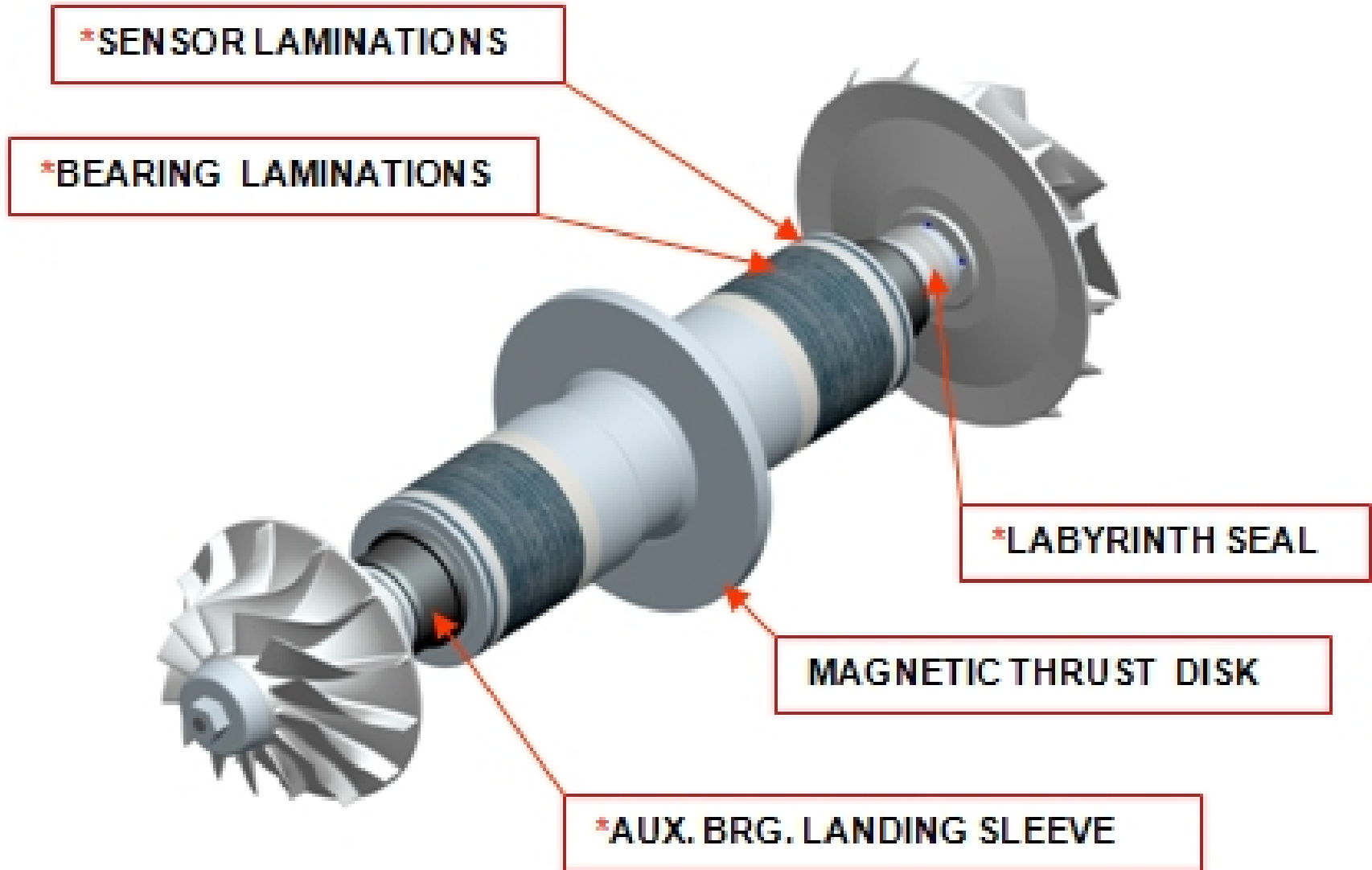
Turboexpander Cross Section



Turboexpander – Magnetic Bearings

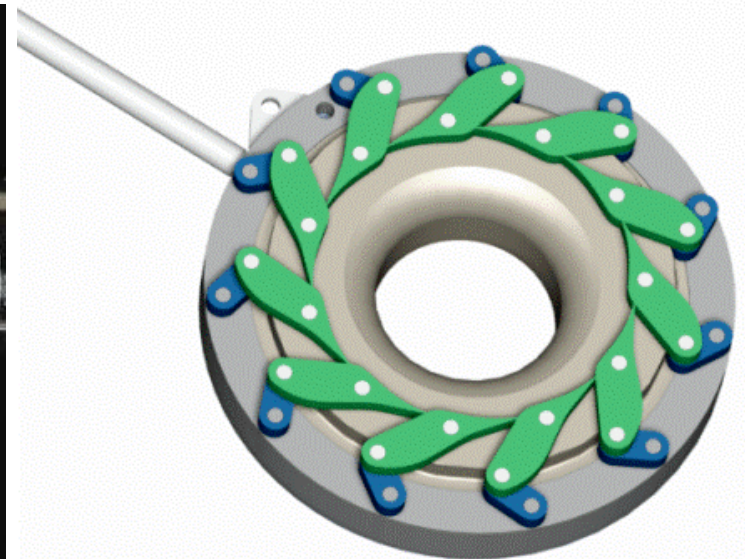


Turboexpander – Magnetic Bearing Rotor

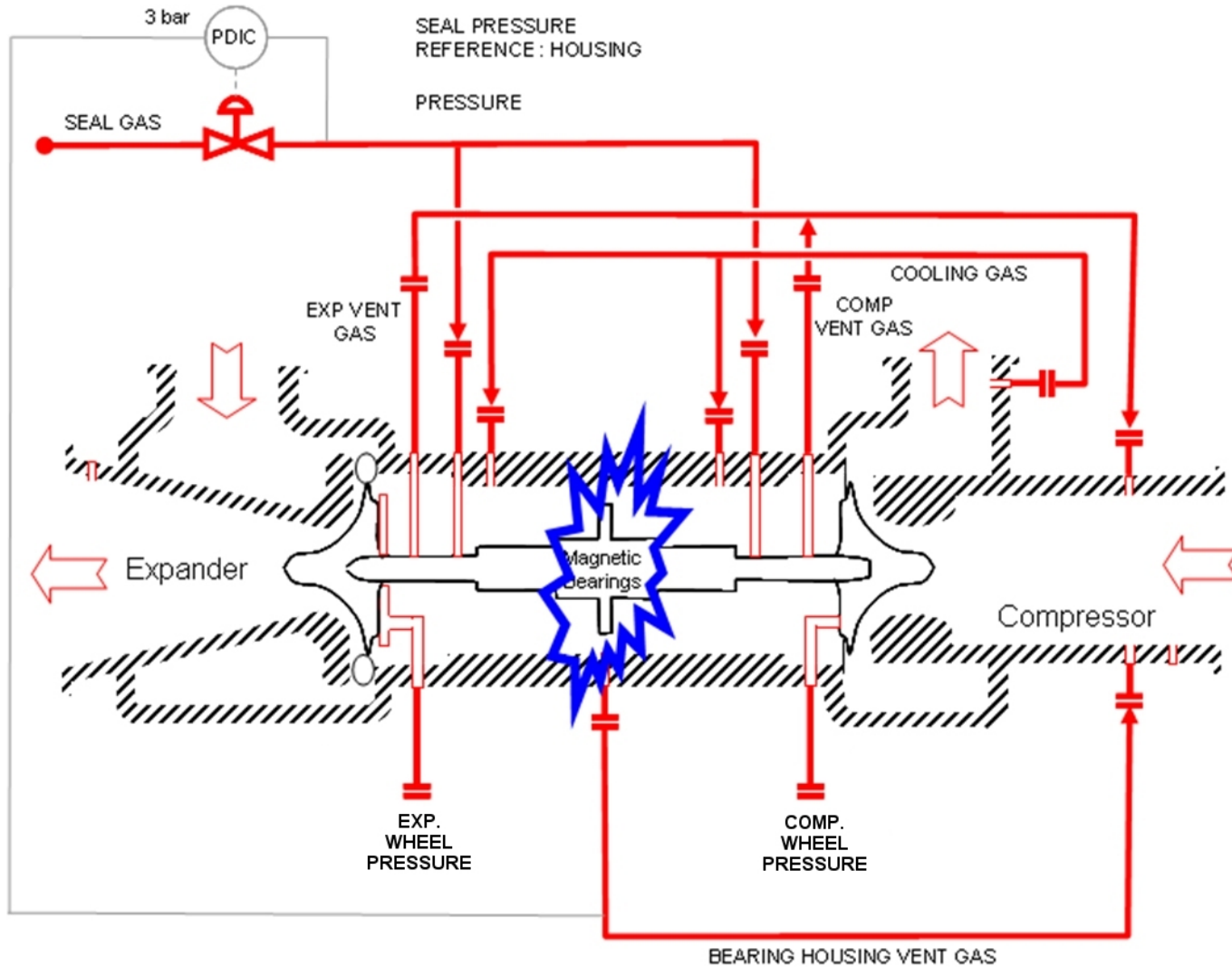


Potential Turboexpander Issues with Hydrates:

- Blockage of inlet screen – possibility of collapsing
- Freezing of IGV segments – loss of process control
- Rotor Unbalance – high radial vibration
- Blockage of discharge piping – reducing turbo expander Δp
- Blockage of wheel axial balancing ports – high axial load
- Ice particle impingement – erosion of wheel and IGVs

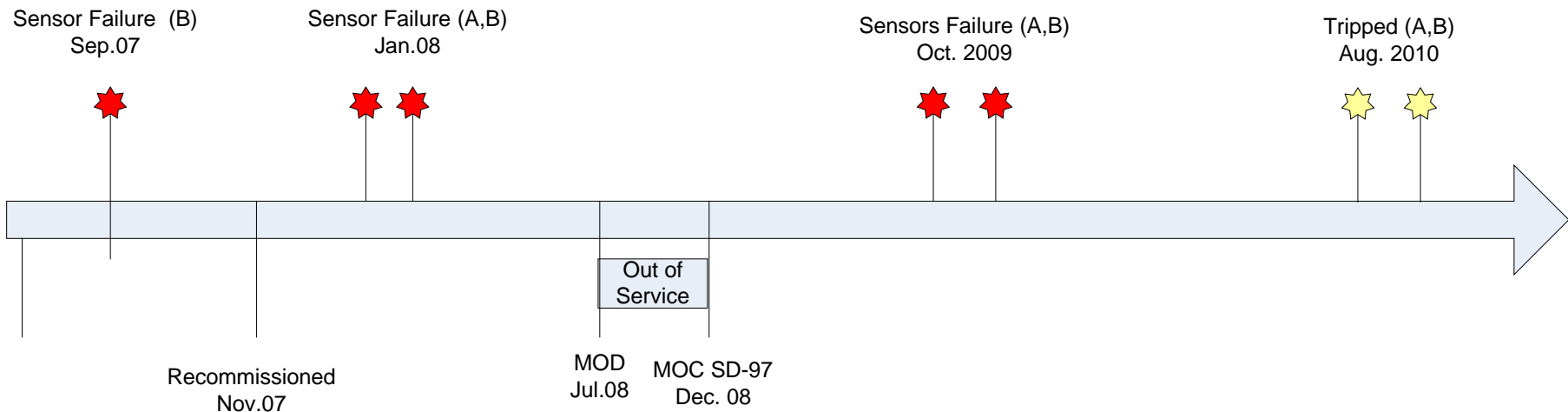


Original Sealing System:

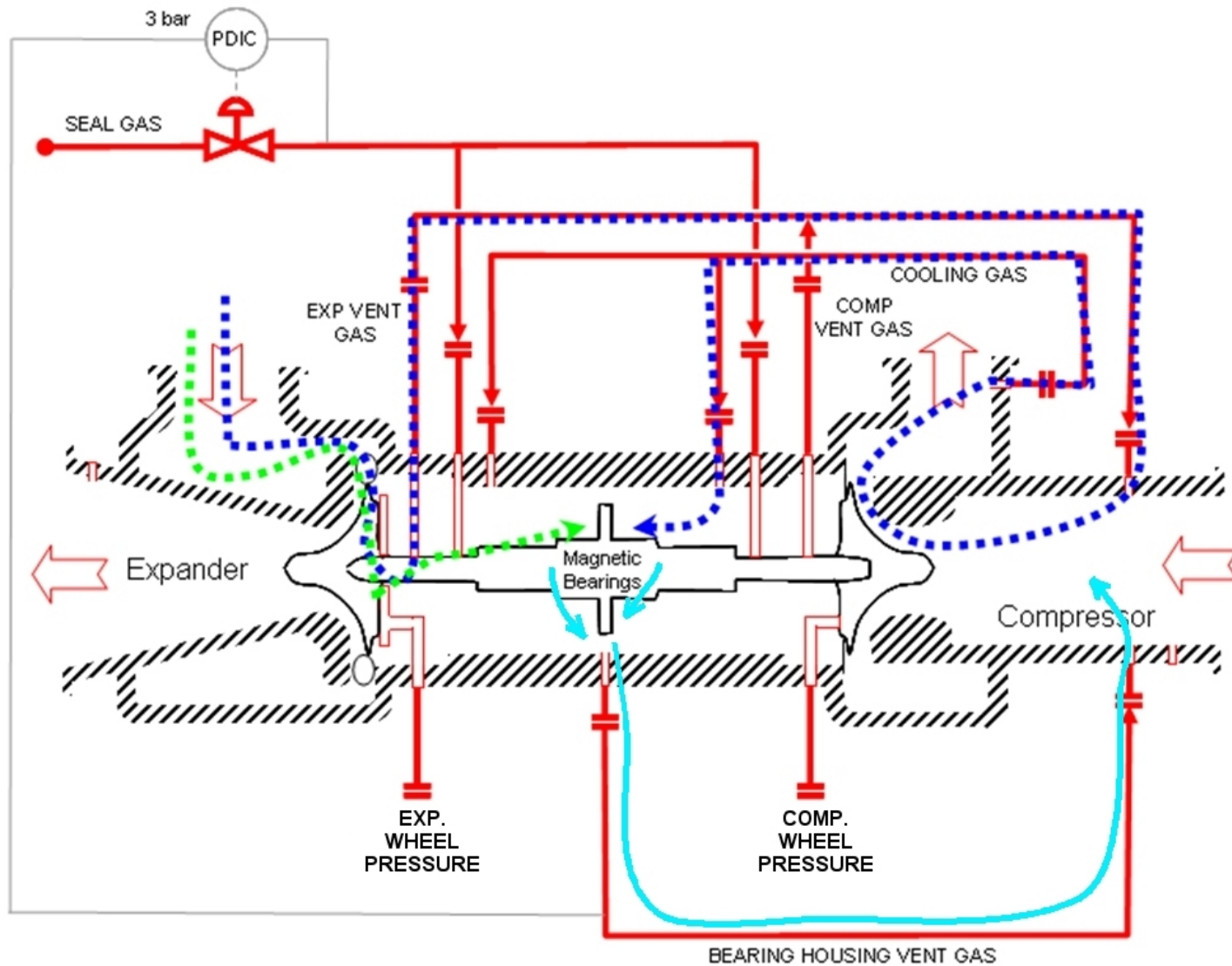


Operation History:

- There are two Turboexpander/Compressor trains
- Production loss \$ 0.5 million per day
- First failure, a few months after commissioning



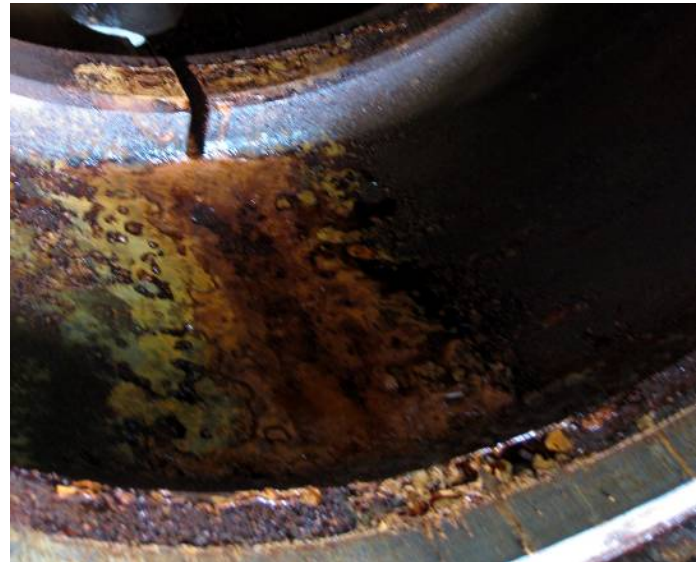
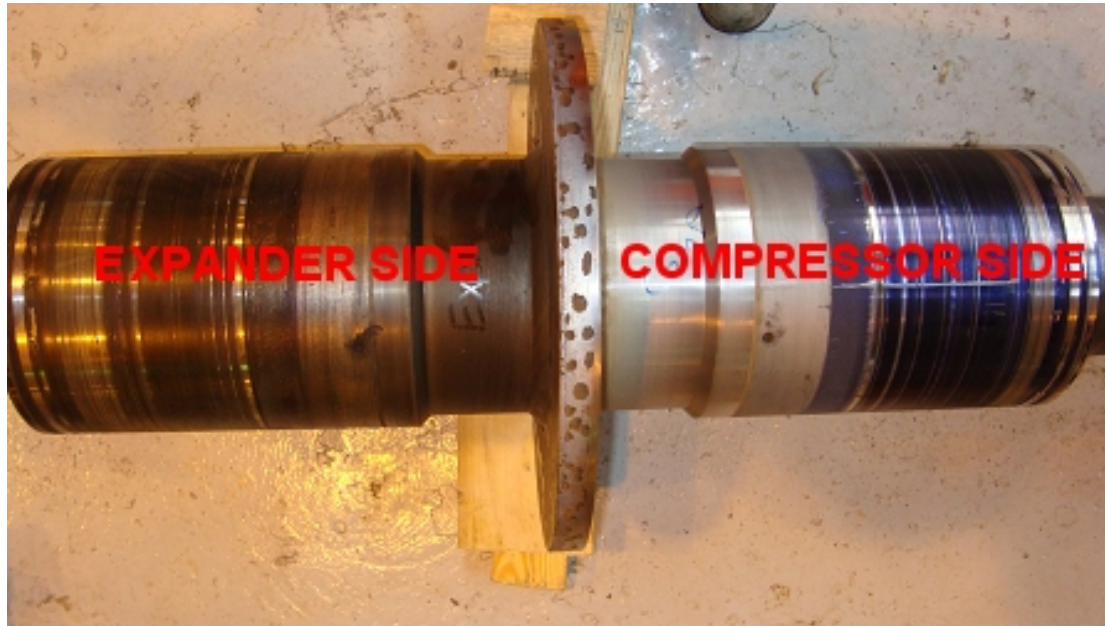
MEG Ingress to Bearing Housing During Process Upset



Polar Liquid Affecting AMB Sensors, Hence Loss of Bearing Control



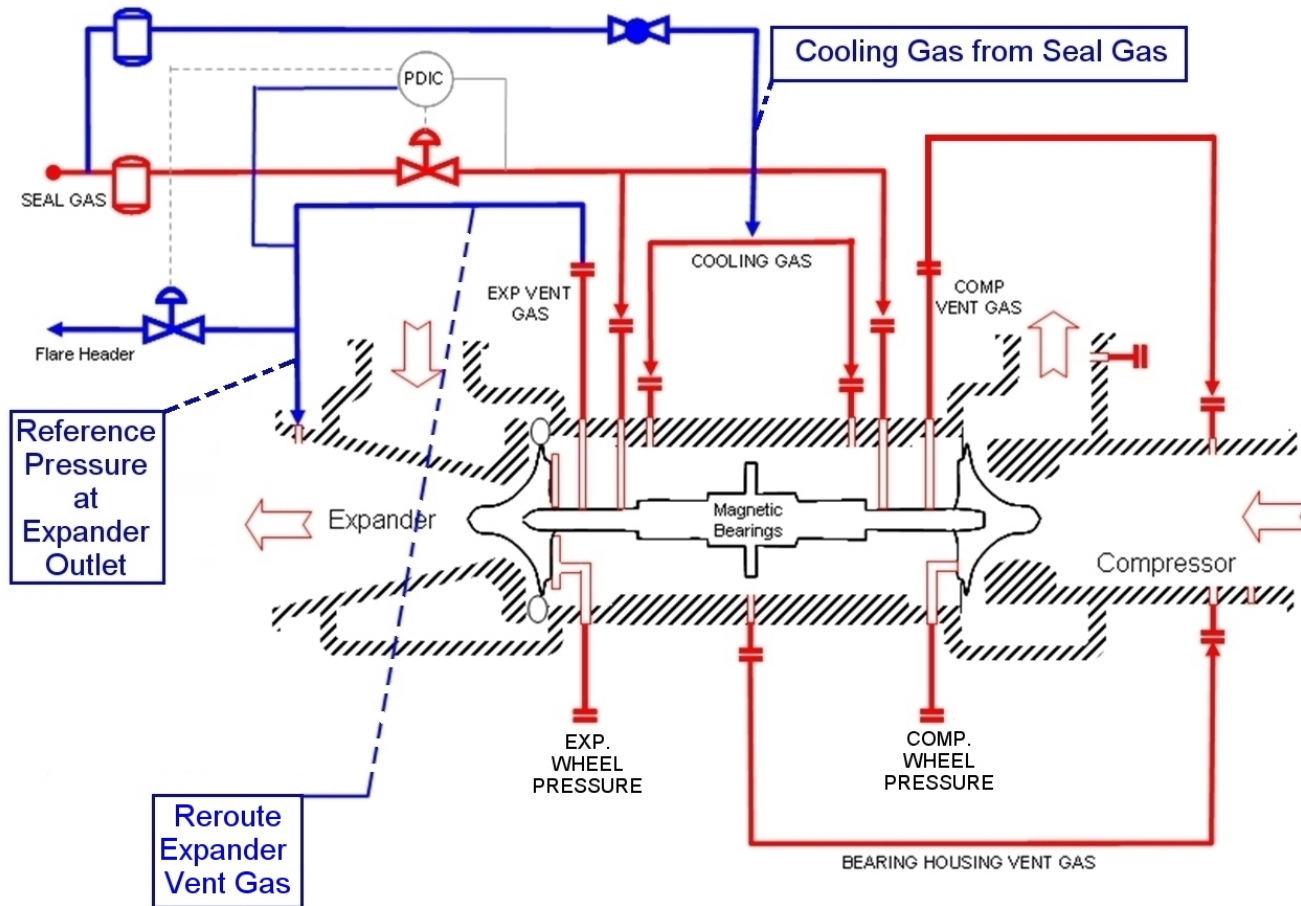
Damaged Rotor / Bearing System



MEG Ingress to Compressor Casing



Modification of the Sealing System



Summary of Modifications:

- Shaft Seal vent routing
- Installation of a dump valve to reduce the shaft seal vent port pressure
- Seal Gas header pressure was raised to Max. allowed by the process (85 bar ~ 1230 PSI)
- Change of control logic, quickly opening to avoid sudden back pressure on the seal
- Controller was tuned for faster action

Conclusions:

- Magnetic bearings should be protected from process contamination such as MEG, wet H₂S , Mercury, etc.
- Effective counter measure for protection against ingress of contaminant shall be provided.
- All up-set conditions shall be checked during initial process simulation and results considered during system design.

Questions?

**Thank you for you interest
and attendance!**