Extending the Life of Compressors

Paul Hassall, Application Engineer - Compressors

EthosEnergy

Portfolio

Our services

We provide a full range of independent and OEM approved solutions for your turbine, generator and transformer products and services that are specific to your industry.

Gas turbines

Full-service provider offering gas turbine solutions across a range of OEMs.

Steam turbines

Industry-leading engineered solutions and turnkey support to increase reliability and efficiency.

Generators

Services include manufacturing of stators and rotors to generator winding kits.

Compressors

Inspect, repair, reverse-engineer and re-build centrifugal, axial and integrally geared compressors.

Transformers

Design and manufacture new grid transformers, autotransformers, and generator step-up (GSU)..

Field services

24/7 turbomachinery field services, rapid mobilization and industry leading safety performance

Operations and maintenance

Comprehensive third-party facility operations and maintenance service for power plants.

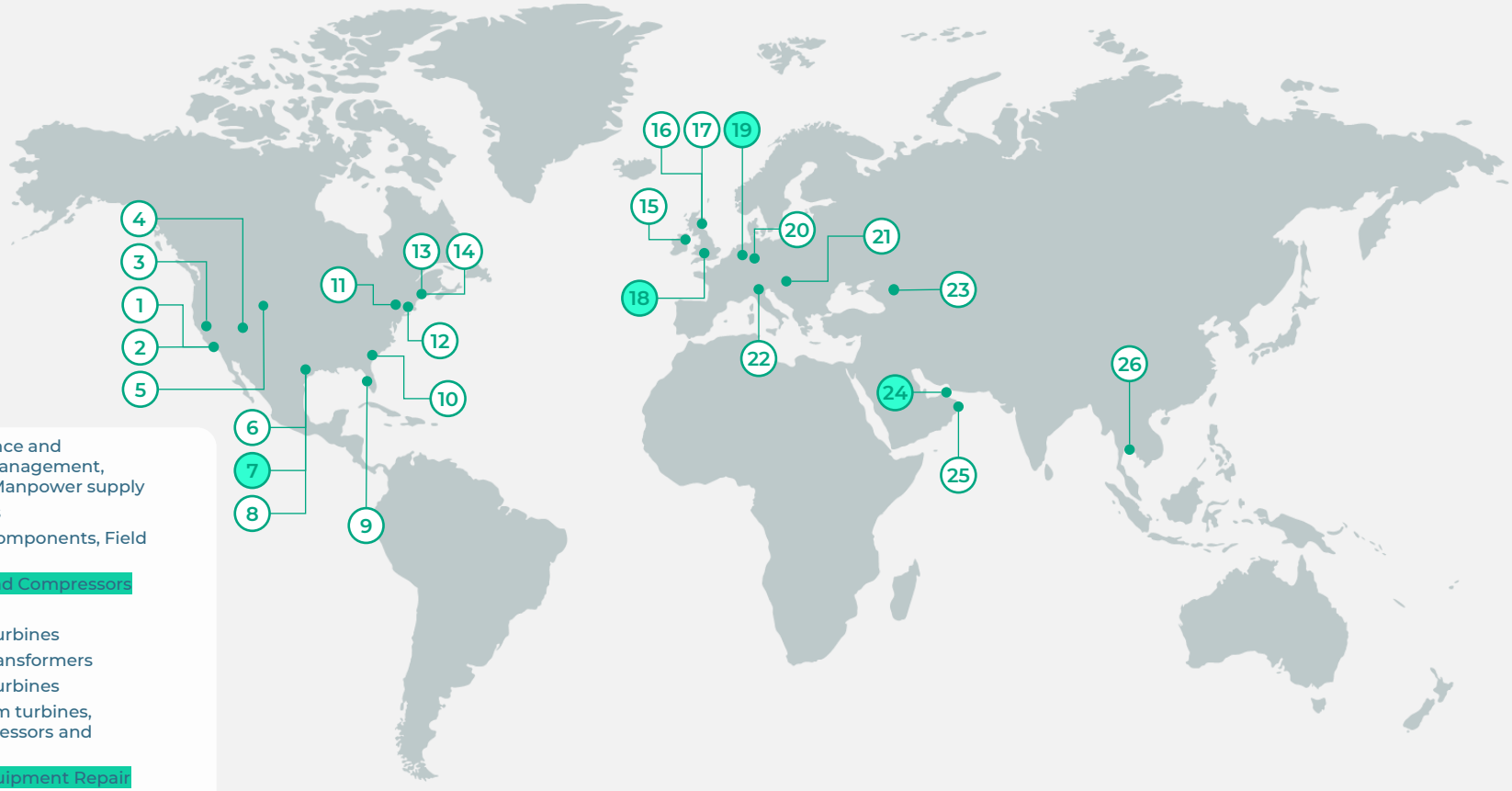
Supporting services

Steel construction, oilfield services and material handling in select geographical locations.

Global Footprint – Compressor Support

We are where you need us

Our facilities are unique centers of excellence with technologies and expertise that cover all equipment types.



1. Steam Turbines
2. Union Field Services
3. Union Field Services
4. Generators
5. Optimization and Upgrades
6. Light Gas Turbines Service Shop
7. Steam and Gas Turbines, Centrifugal Compressors
8. Operations and Maintenance
9. Gas Turbine Efficiency
10. Accessories and Components
11. Aero derivative gas turbines
12. Accessories and Components
13. Steam Turbine Engineering
14. Steam Turbine Component Manufacturing and Repair
15. Project, Performance and Commissioning management, Consultancy and Manpower supply
16. Light Gas Turbines
17. Accessories and Components, Field Service
18. Steam Turbines and Compressors
19. Compressors
20. Heavy Industrial Turbines
21. Generators and Transformers
22. Heavy Industrial Turbines
23. Gas turbines, steam turbines, generators, compressors and transformers
24. Rotary & Static Equipment Repair
25. Oilfield Equipment Repair Shop
26. Heavy Gas Turbines Component Repair

Energy Security & Emissions Reduction

CHALLENGES

1. Compressors are operating beyond their intended life.
2. Maintaining uptime with lower OPEX budgets.
3. Depleting fields have an impact on compressor performance and emissions.
4. Emission reduction projects have long lead-times, high costs & at times impact availability.

FOCUS AREAS

1. Safeguarding equipment & reliability improvements.
2. Finding cost effective upgrades.
3. Performance assessments.
4. Reducing hydrocarbon venting.

Safeguarding Equipment & Reliability Improvements

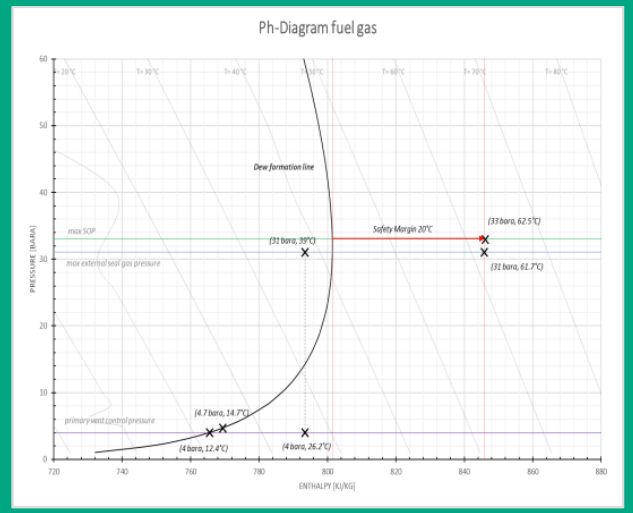
Seal Gas Verification Study on two LP compression trains, initially running with suction pressure of 60 bara, with an existing suction pressure of 4.7 bara.

FINDINGS

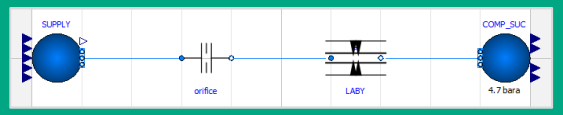
1. Dew formation risk on Ph-Diagram
2. Velocity across process labyrinths under API 692 requirements
3. Set-points too insensitive and ineffective
4. Low leakage rates for Tandem seal arrangement

SOLUTIONS

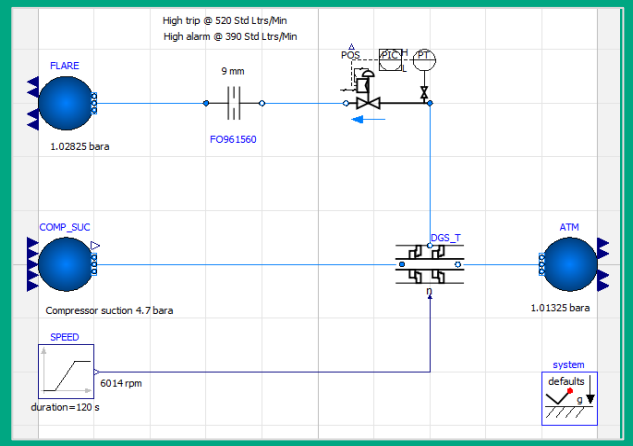
1. Install heater and maintain heat tracing
2. Adjust seal gas supply needle valves & install executing action
3. Lower alarm set-point and upgrade instrumentation
4. Install seal stabilization line



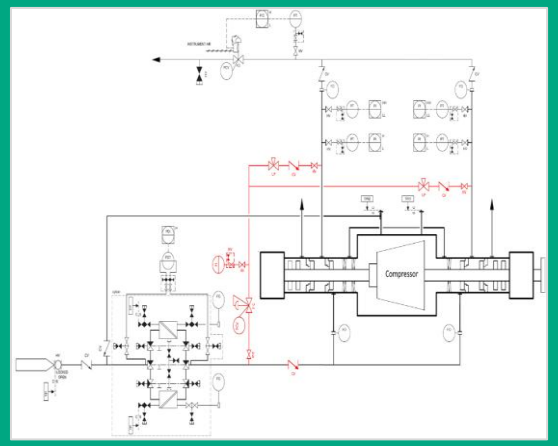
Ph Diagram



Seal Gas Supply Model



Seal System Model



Stabilization Line

Cost Effective Upgrades

Offshore Compressor Thrust Bearing suffering from temperature excursions and bearing fatigue.

FINDINGS

1. Thrust curves are out with API 617 guidelines.
2. Compressor operating point within load rating
3. Balance diameter
4. High pad temperature due to high surface speed

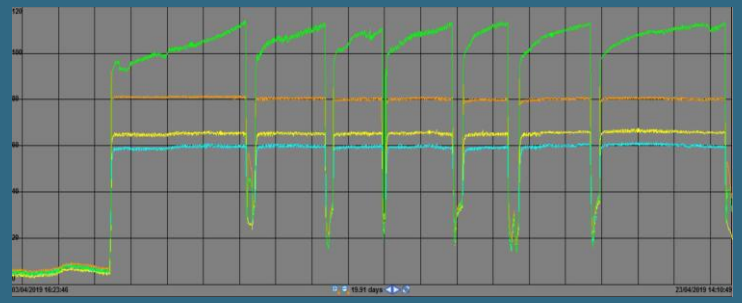
SOLUTIONS

1. Change from a centre to an offset tilting pad
2. Upgrade bearing material to increase load rating
3. Change of mineral oil specification

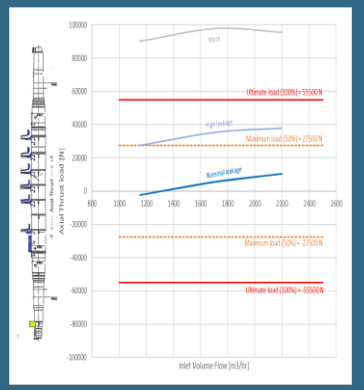
KEY RESULTS

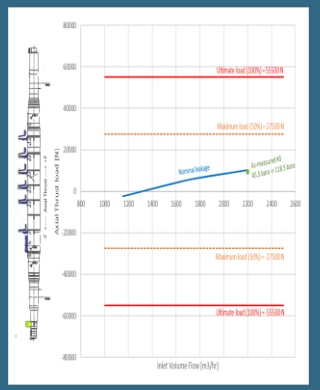
1. Reduced operating expenditure and increased MTBF
2. Improved availability and uptime

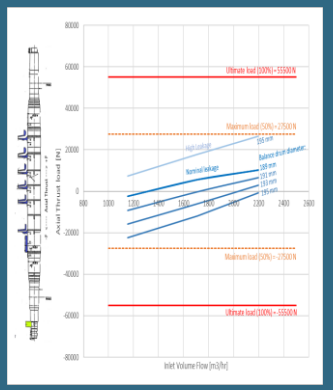
Thrust bearing



MTBF trend data







Thrust curves

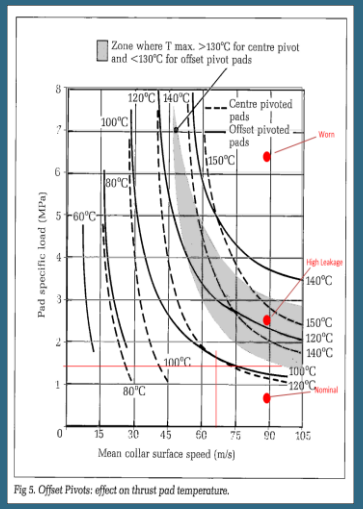
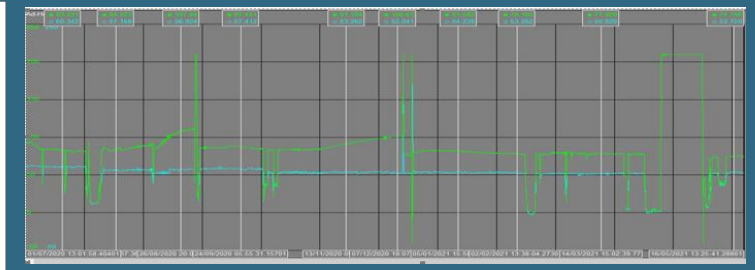


Fig 5. Offset Pivots: effect on thrust pad temperature.

Bearing design data



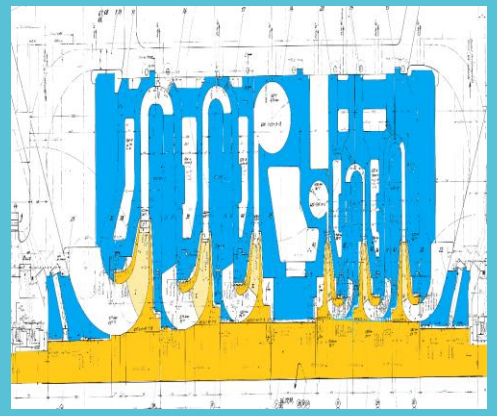
Trend data

Performance Assessment

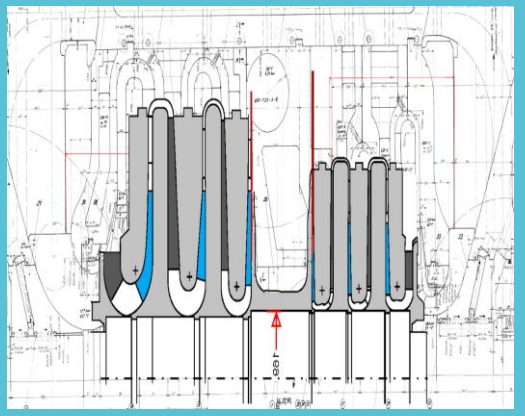
Conceptual design study for a compressor re-rate opportunity, based on existing operational demands.

FINDINGS

1. Design flow rate rating above operating demand
2. Re-rate is feasible inside existing casing
3. Considerable power saving & CO_2 emission reduction



Original design



Rerate design

Yearly Energy Saving (OPEX)		
Mechanical Power saving (E-motor)	950	kW
Thermal Power saving of GT powered generator assuming open cycle GT efficiency 30%	3170	kW
Yearly Mechanical energy saving assuming 95% Availability (8300 hr)	7,885,000	kWh
Yearly CO2 emission reduction (GT powered generator) assuming 0.18 kgCO2/kWh emission	4736	ton/year
OPEX Energy saving assuming 0.07 Eur/kWh	551,950	EUR/year
OPEX Emission cost saving assuming 50 Eur/tCO2	236,800	EUR/year
TOTAL savings per year	**788,750**	**EUR/year**

Reducing Hydrocarbon Venting

Modification of a Dry Gas Seal system to cater for a decline in suction pressure (3.4 bara to 2.1 bara)

FINDINGS

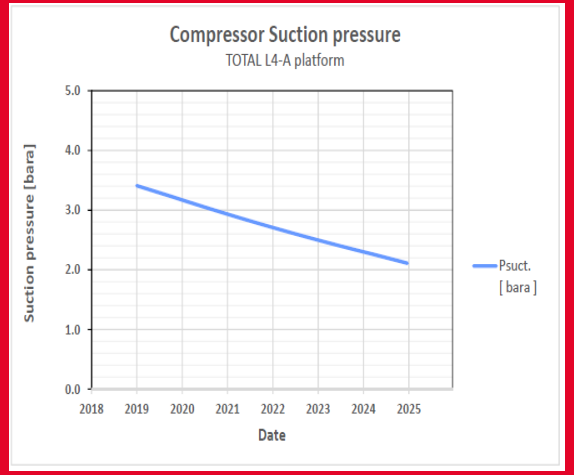
1. Existing Tandem seal arrangement unsuitable
2. Pipework & auxiliaries to be modified

SOLUTIONS

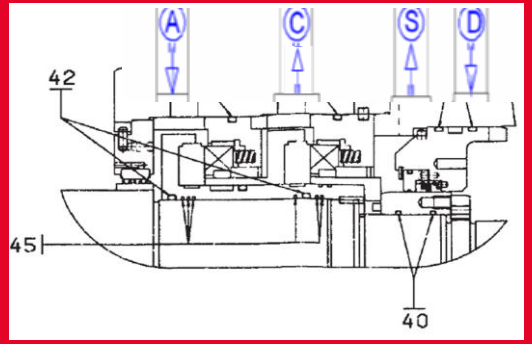
1. Change design to a double opposed seal
2. Re-use primary vent line for N2 Seal Gas Supply

KEY RESULTS

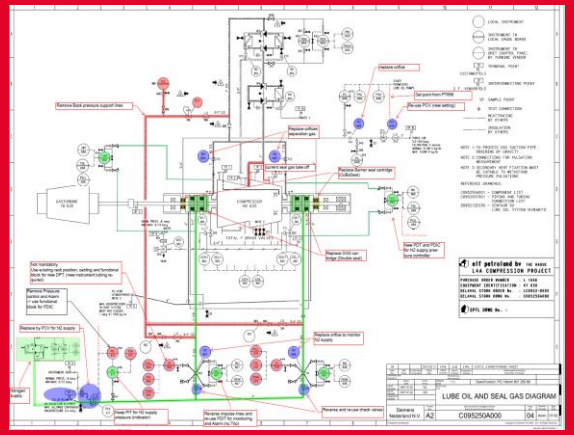
1. Operating life extension of compressor
2. Zero seal emissions



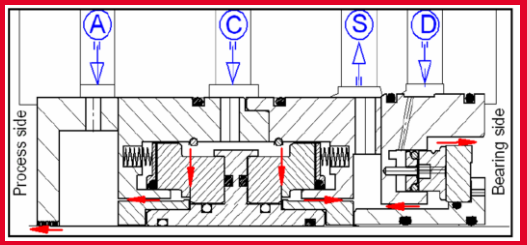
Suction pressure trend



Tandem seal arrangement



P&ID mark-up



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