PERTAMINA GAS

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PERTAGAS INTEGRATED PIPELINE AND ENERGY SUMMIT

INDOTURBINE PT.

Achieving Compressor Reliability & Efficiency

Through Appropriate Maintenance Techniques

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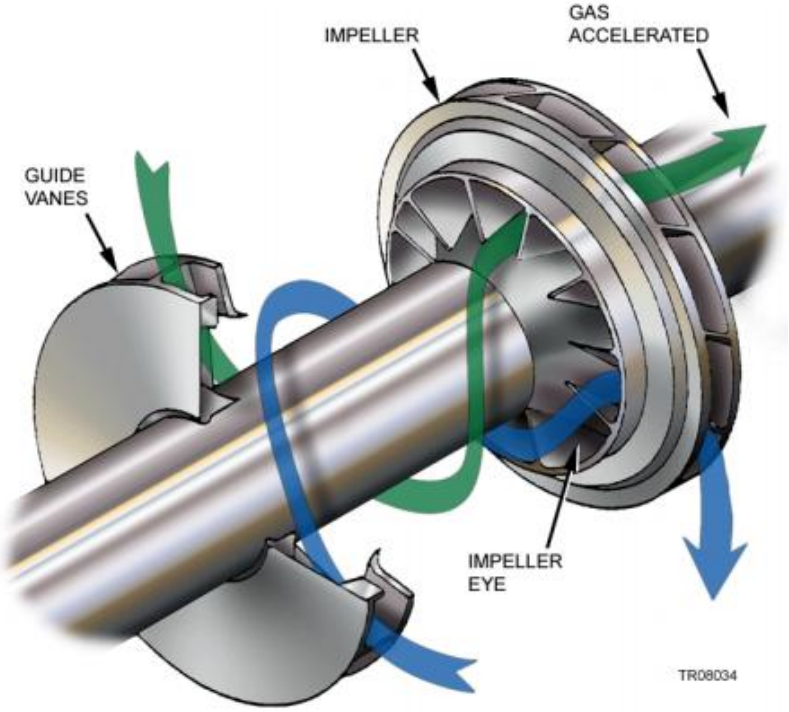
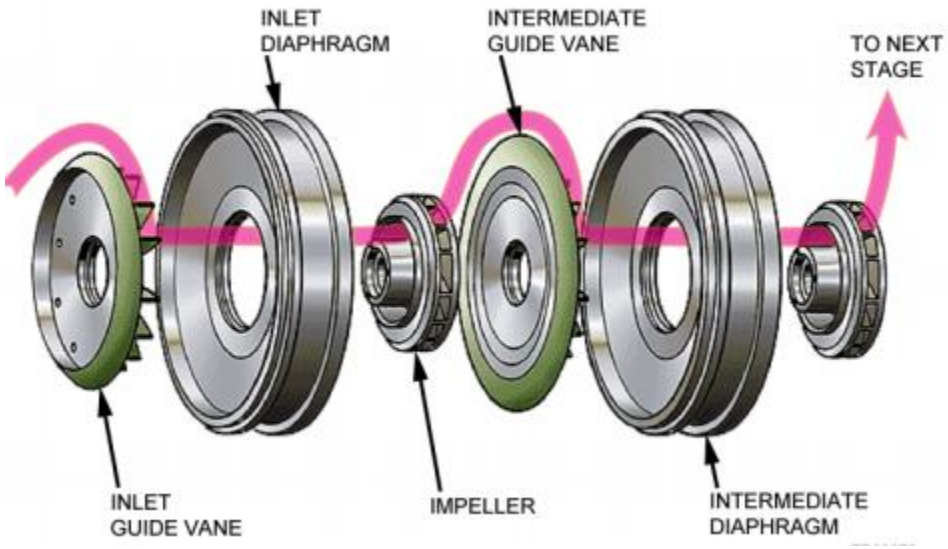
Introduction to Centrifugal Compressors

Operating Principles of Gas Boost Compressor

- Increase in pressure of the gas by transferring rotating energy from the impellers installed on the rotating shaft.
- Gas enters into the compressor through the suction inlet chamber, and is directed towards the rotating impeller by the stationary inlet guide vane assembly.
- The inlet guide vane assembly changes the direction of the flowing gas from radial to axial flow prior to entering the rotating impeller.



INTRODUCTION TO CENTRIFUGAL COMPRESSORS



- As the gas passes across the rotating impeller, energy is imparted to the gas stream in the form of increased velocity.
- As the gas travels from the impeller eye towards the tip (edge) of the impeller, it also effectively has the effect of increasing the pressure of the gas.
- As the gas exits the rotating impeller, it enters into the stationary diffuser (formed by the next guide vane and diaphragm assembly), where a further increase in pressure occurs. The pressure increase across a single impeller and stator section (collectively known as a compressor stage) may be relatively low.
- Multiple Stage Installed to achieve pressure requirement

COMPRESSOR COMPONENT

1. CASING OR CENTER BODY

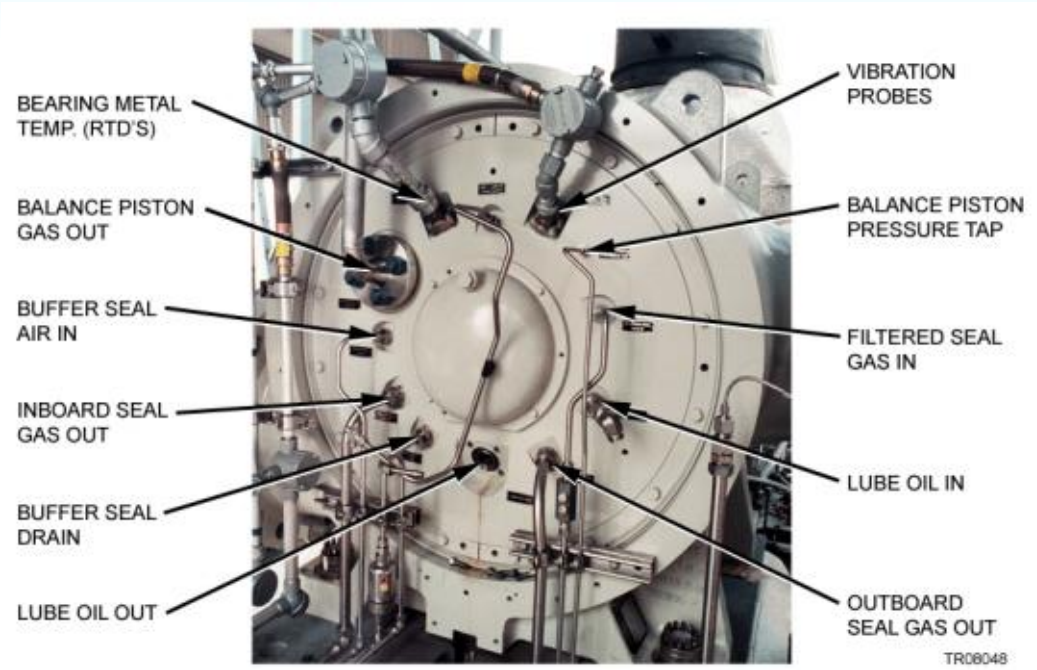
- A single piece, barrel-type center body with removable suction and discharge end caps.

COMPRESSOR COMPONENT

2. SUCTION AND DISCHARGE END CAP

- Removable end caps are located at the suction and discharge ends of the compressor center body.

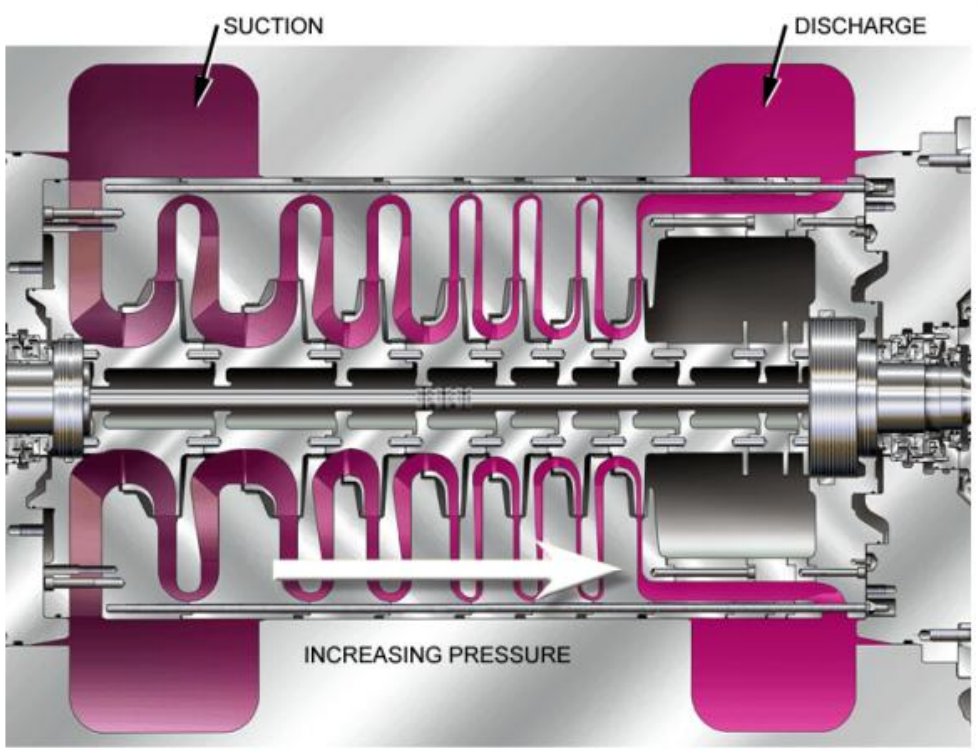
- Support for both the radial bearing assemblies at both ends that support the compressor rotor, the axial thrust bearing assembly installed at the suction end, and the seal assemblies at both ends that prevent process gas escaping from the compressor along the compressor rotor shaft.



COMPRESSOR COMPONENT

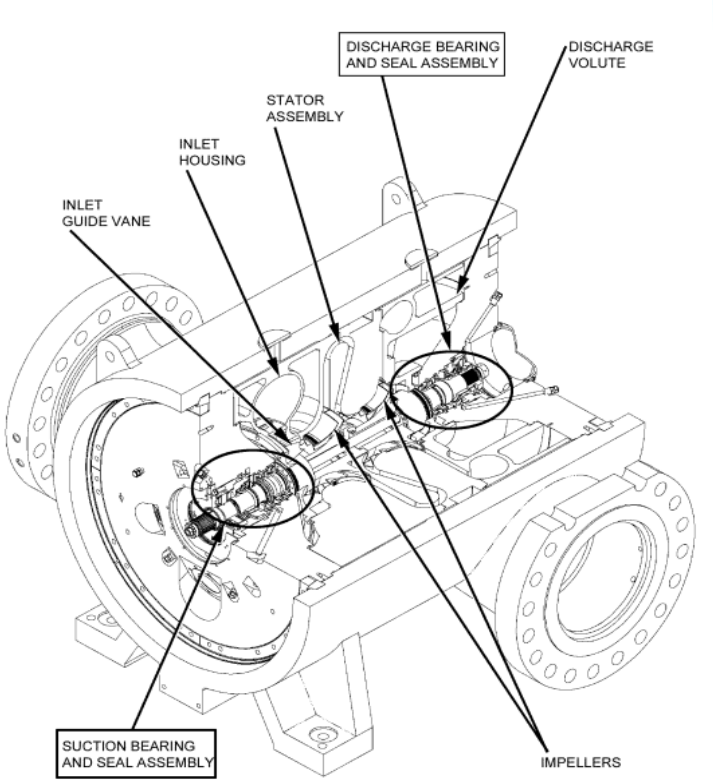
3. AERO BUNDLE

- The stationary components for one compressor stage consists of a Guide Vane and a Diaphragm.
- The addition of one rotating impeller will complete the aerodynamic components for one stage.
- This combination of aerodynamic components to be installed inside the compressor casing is collectively known as the aerodynamic-module or bundle



COMPRESSOR COMPONENT

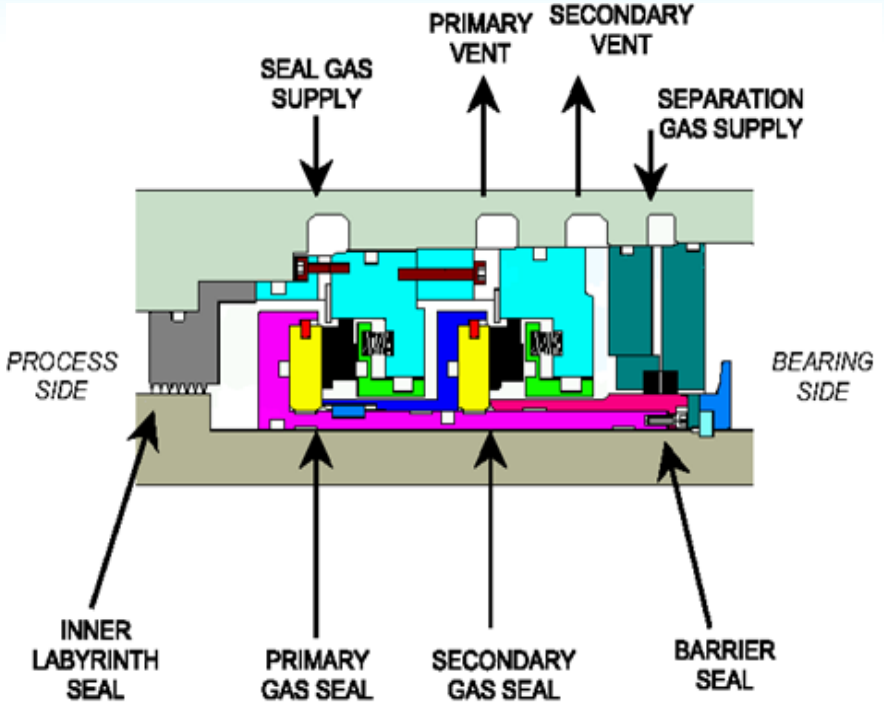
3. SEAL & BEARING ASSY



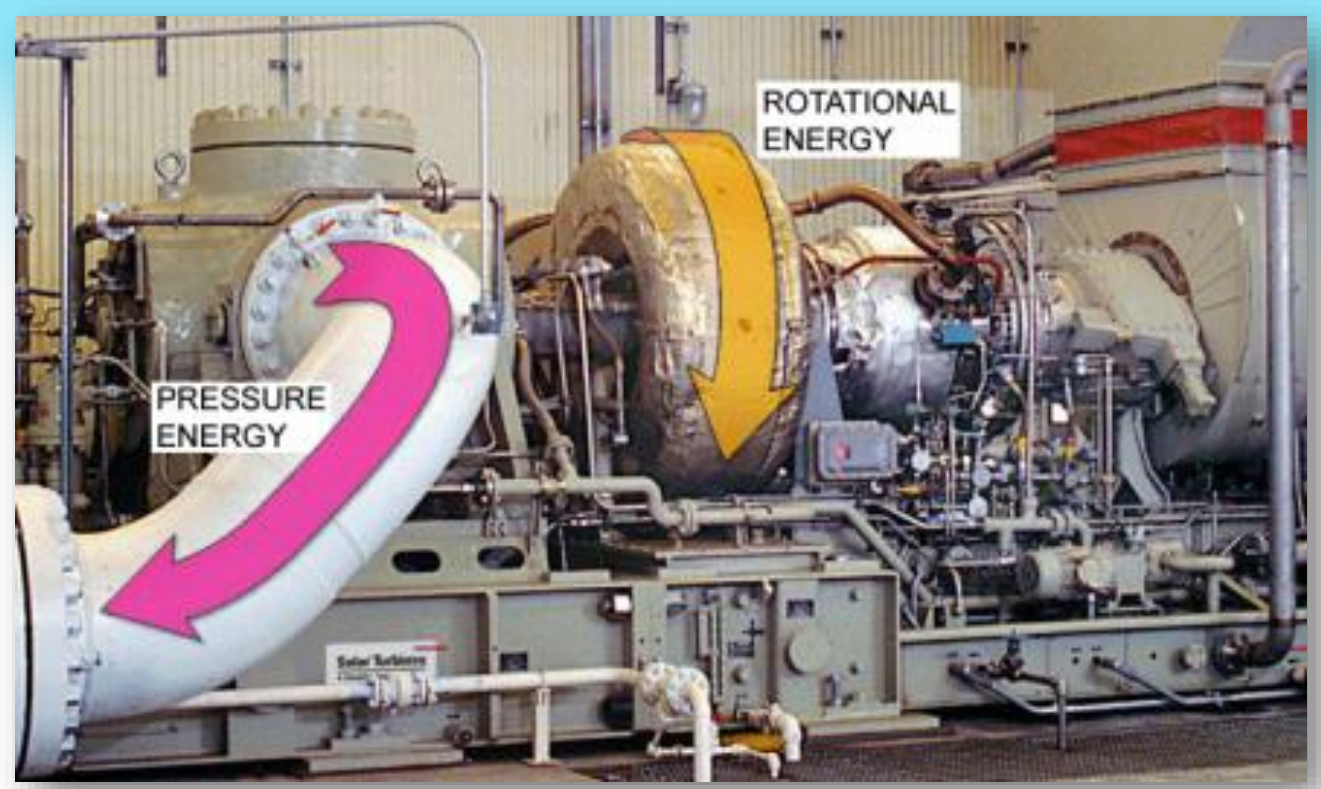
COMPRESSOR COMPONENT

4. DRY GAS SEAL SYSTEM

- To contain the process gas within the confines of the compressor body
- To prevent process gas escaping the compressor along the shaft it is done by using of mechanical Seal and pressurized Seal Gas Barrier
- Combination of mechanical seal and seal gas barrier Prevent pressurized lube oil migrating into the compressor and V.V.



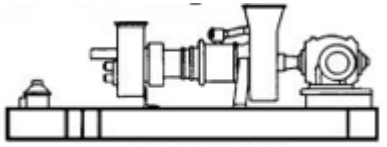
GAS BOOST COMPRESSOR PURPOSE



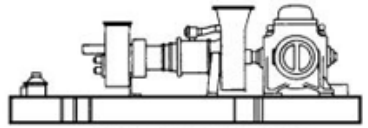
Compress a fluid, normally natural gas, to deliver it at a pressure higher than the original to meet the specific requirements of the application or process.

GAS BOOST COMPRESSOR APPLICATION

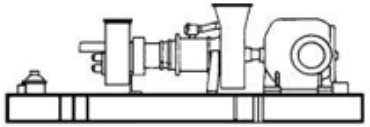
1. TRANSMISSION
From gas field/plant to consumer (city utility company)


TRANSMISSION

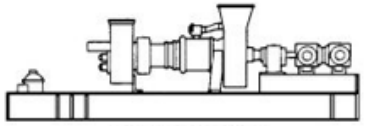
2. STORAGE/RE-INJECTION
Gas injected to a storage site for pressure maintenance or storage


STORAGE / REINJECTION

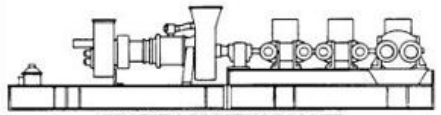
3. GATHERING
Handling well gas at the well or other gathering location upstream of the gas plant booster.


GATHERING

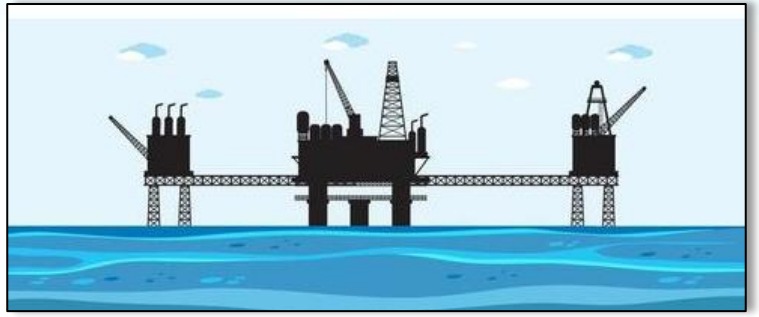
4. HIGH PRESSURE
All application need high pressure gas, >1500 psi discharge


HIGH PRESSURE

5. GAS LIFT
Gas injected to a well to aerate crude


HIGH RATIO BOOSTING/GAS LIFT
(TANDEM APPLICATIONS)

GAS BOOST COMPRESSOR TRANSMISSION



OFFSHORE

200 PSI

<50 PSI

Gas Pipe Distance 170 KM

ONSHORE END USER

Example Gas Pressure required by customer min at 300 PSI, Without Gas Boost Compressor Gas pressure from Well which is at 200 PSI will decrease due to long lenght of pipe, End user only get < 50 PSI of Gas Pressure

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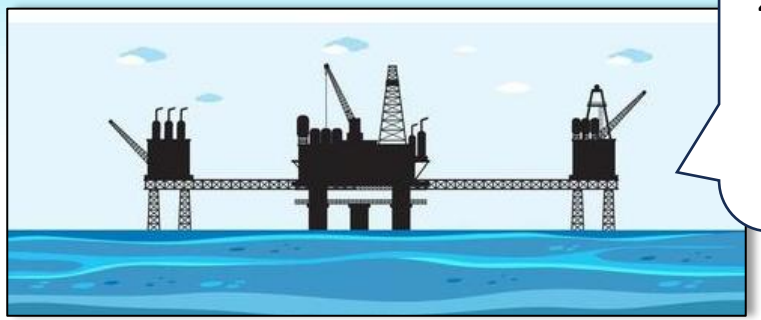
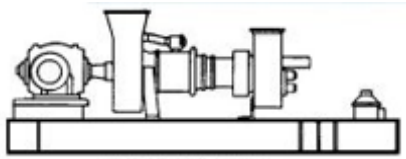
GAS COMPRESSOR TRANBOOSTSMISSION



OFFSHORE GAS WELL PLATFORM

200 PSI



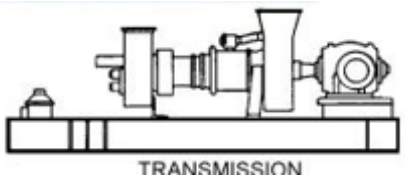
500 PSI

OFFSHORE GAS BOOST COMP

120 KM

With Installation of Gas Boost Compressor near the gas well and in the half length of Gas pipe, Gas pressure at the customer will be achieved as per customer expected.

200 PSI



ONSHORE GAS BOOST COMP

500 PSI

50KM

350 PSI

ONSHORE END USER

Total distance 170 KM

Why Reliability and Efficiency Matter

Reliability and efficiency are crucial for gas boost compressors because they directly impact **safety, cost, performance, and operational continuity**—especially in industries where high-pressure gases are used or stored. Here's a detailed breakdown of **why they matter**:

Reliability: Ensuring Continuous and Safe Operation

Why it matters:

- **Safety:** Compressors often handle high-pressure and hazardous gases, A failure could lead to **leaks, explosions, or toxic exposure**.
- **Downtime Costs:** In industrial settings, unexpected shutdowns can cause **production losses**, delay projects, or disrupt critical processes.
- **Maintenance Burden:** Unreliable systems require **frequent repairs**, increasing labor and spare parts costs.
- **Regulatory Compliance:** In energy sectors, failure to maintain reliable systems can **violate safety and environmental regulations**.

Example: In a Gas Compression Transmission, a compressor failure will stop the Gas Flow and affected end user operation such as, Power Plant, Fertilizer Plant and other Industrial that really depend on Gas Supply

Efficiency: Reducing Energy and Operating Costs

Why it matters:

- **Energy Consumption:** Compressing gas is energy-intensive. **Efficient compressors use less power**, reducing electricity costs and environmental impact.
- **Heat Management:** Efficient systems reduce excess heat, which lowers the **cooling load** and prevents thermal degradation of components.
- **Longer Equipment Life:** Lower wear-and-tear from efficient operation extends the **life of components**, delaying capital expenditures.
- **Return on Investment (ROI):** High efficiency translates into **faster payback periods** on equipment costs.

Example: A 10% increase in compressor efficiency in a continuous-use application can lead to **thousands of dollars in annual energy savings**.

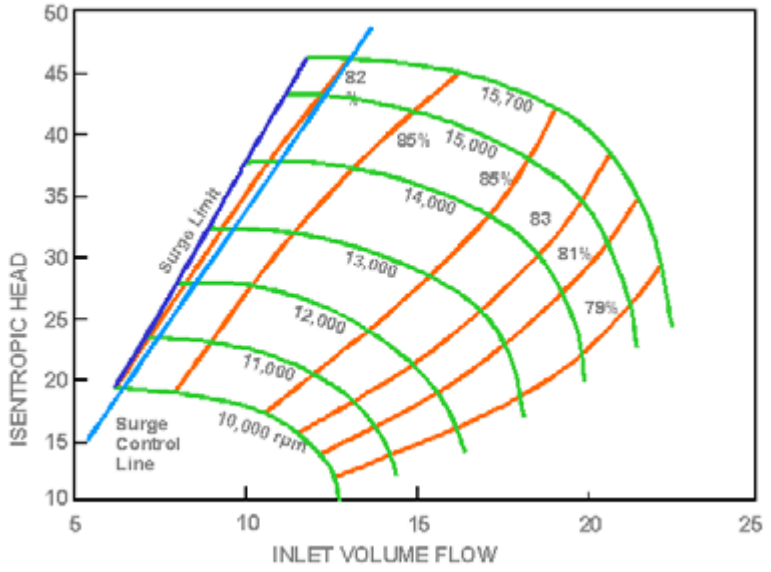
Common Reliability Issues

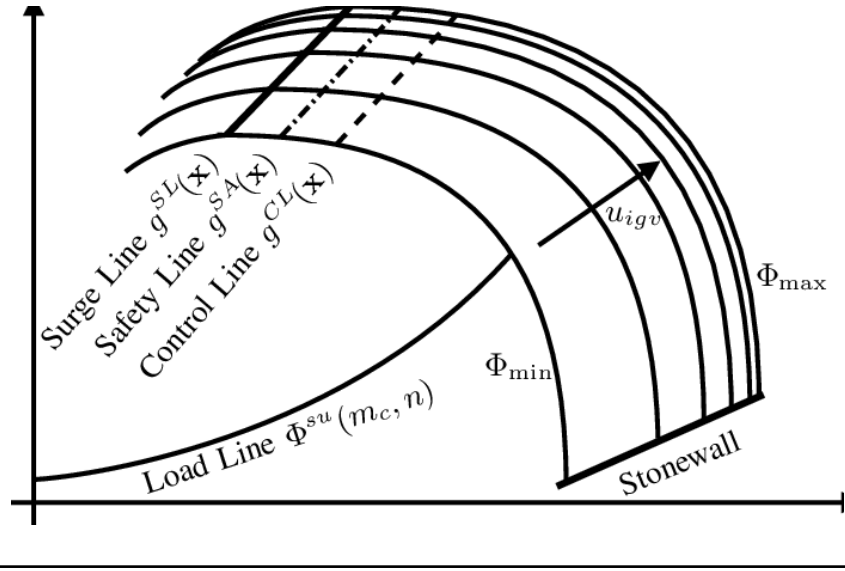
Image 1.1 Bearing Failures

Image 1.2 Fouling and corrosion

1. **Seal leakage**
2. **Imbalance and misalignment**
3. **Surge and stall events**

Time For Restaging





Maintenance Strategies Overview

Maintenance Classification divide into :

- Corrective/reactive Maintenance: Costly and risky
- Preventive Maintenance (PM)
- Predictive Maintenance (PdM)
- Condition-Based Maintenance (CBM)

CORRECTIVE MAINTENANCE

Similar with Breakdown Maintenance or Repair Maintenance, a failure occurs repairs are made and parts replaced as needed. This type of maintenance is non-managed and is purely reactive.

Advantages

- Low Cost Maintenance
- Minimize of man power

Disadvantages

- High of number unscheduled SD
- High number of lost revenue
- Increased cost to recover
- Outage equipment for extended period

PREVENTIVE MAINTENANCE (PM)

Well planned and executed properly maintenance such as regular inspection schedule, lubrication program, alignment and balancing checks, filter and seal replacements, and vibration monitoring

Advantages

- Increased Reability
- Increased Performance
- Reduce equipment Down time
- Increased ability to forecast cost
- Lower overall operating cost

Disadvantages

- Increased cost for spare part
- Increased cost for maintenance staff
- Increased cost to recover
- Outage equipment for extended period

PREDICTIVE MAINTENANCE (PdM)

Predictive maintenance (PdM) is a proactive maintenance strategy that uses **data and analytics** to **predict when equipment (like a gas boost compressor) will fail or degrade**—so maintenance can be performed *just in time*, before breakdowns occur.

Predictive maintenance involves:
Monitoring real-time data from sensors (vibration, temperature, pressure, noise, etc.) Using **AI/machine learning models or trend analysis** to predict failures or performance drops Scheduling maintenance **only when needed**, not just at fixed intervals (like preventive maintenance)

What Can Be Predicted?

Failure Type	Detectable Through
Bearing wear	Vibration analysis, acoustic sensors
Valve leakage	Pressure differentials, flow rates
Motor failure	Temperature and current anomalies
Lubrication issues	Oil analysis, thermal imaging

Advantages

- Potential cost saving due to only carrying out maintenance when needed
- Ensuring maximum service life of components
- Reduced equipment outage time

GAS BOOST COMPRESSOR MAINTENANCE

Best Practice for maintenance are :

- Keep detailed maintenance records
- Train staff regularly
- Use OEM-recommended parts and intervals
- Combine PM and PdM approaches
- Plan shutdowns strategically

Thus, will increase reliability and efficiency of gas boost compressor.

SERMALON COATING PART OF PREVENTIVE MAINTENANCE

Coating system was developed primarily to provide anti-fouling and corrosion protection to driven compressor components and industrial gas turbine components exposed to wet chloride attack, as well as steam turbine components

Advantages

1. Smooth surface finish and PTFE impregnated topcoat contribute to performance recovery and reduced fouling rate.
2. Superior resistance to acid rain, deicing fluids, decontamination fluids, hydraulic fluids, lube oils, and jet fuels. Excellent bond strength.
3. Continuous protection against relative humidity to 100 percent, and with continuous salt/mist in air.
4. Excellent coating ductility.
5. No hydrogen embrittlement problems.
6. High resistance to corrosion fatigue.
7. Excellent resistance to hydrocarbon fouling.

SERMALON COATING

Physical Properties:

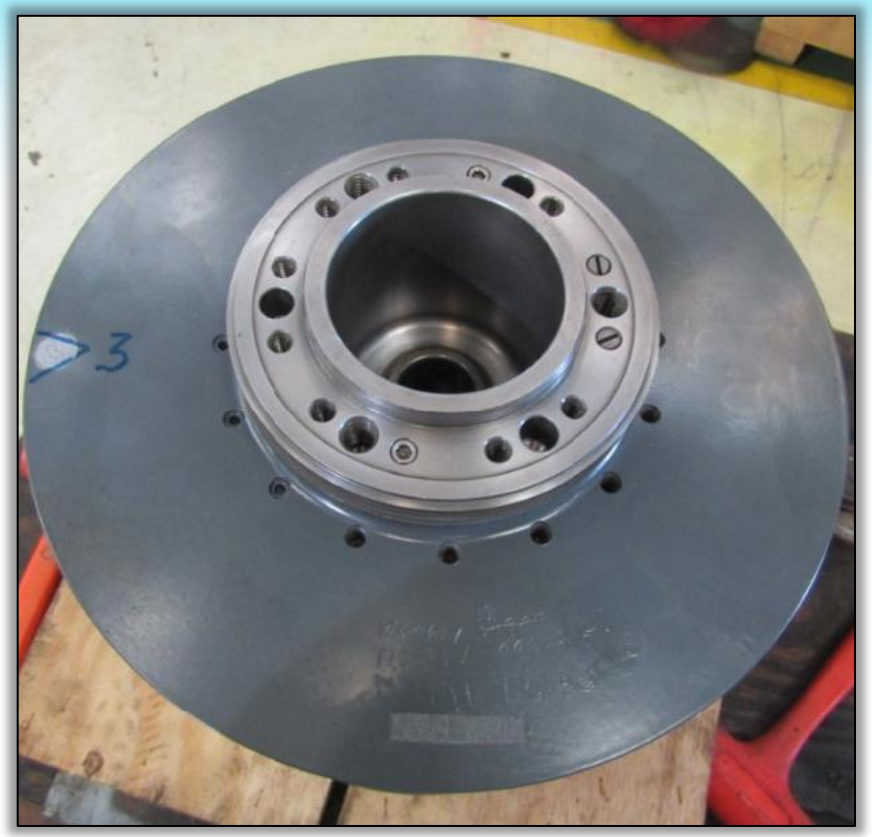
Thickness	: 0,004 – 0,006 inches
Max. Operating Temperature	: 260 C
Peak Operating Temperature	: 315 C for 1 Hour
PH Operating Range	: 3 – 9

Specimen Test Result:

Salt Spray Test (ASTM B117)	: > 3000 Hours with no red rust on 410 stainless steel
Adhesion (ASTM D3359)	: 4 – 5B, No Pick-off / excellent
100% Humidity (ASTM D2247)	: 3000 Hours-no effect
Surface Finish	: 40 microinches Ra at 0,8 mm cut-off on new machine surface

ROTOR WITHOUT SERMALON COATED

ROTOR WITH SERMALON COATED



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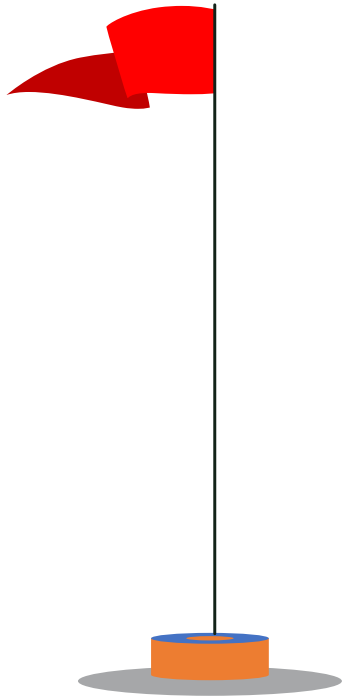
Question & Answer

CONCLUSION

- Maintenance is key to reliability and efficiency
- Adopt a proactive approach
- Leverage technology and data
- Continuously improve based on operational feedback



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