



ASIA TURBOMACHINERY & PUMP SYMPOSIUM  
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# Case Study:

## Recip Pump on Unstable Condensate

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# Presenter/Author Bios

Jason Jakubiak, [jason.jakubiak@peroniamerica.com](mailto:jason.jakubiak@peroniamerica.com)

- General Manager, Peroni Pumps America
- 12 years of rotating equipment experience with pumps, compressors and turbines
- BS Mechanical Engineering from University of Wisconsin-Milwaukee

Luigi Mascherpa, [luigi.mascherpa@peronipompe.it](mailto:luigi.mascherpa@peronipompe.it)

- Technical Manager, Peroni Pompe SpA
- 15 years of experience with reciprocating pump units
- PhD Mechanical Engineering from University Politecnico of Milan



# Executive Summary

- Pump Design Conditions
- Sealing/Packing System Design Features
- Sealing/Packing System Failures
- Pump Improvements
- Conclusions and Lessons Learned



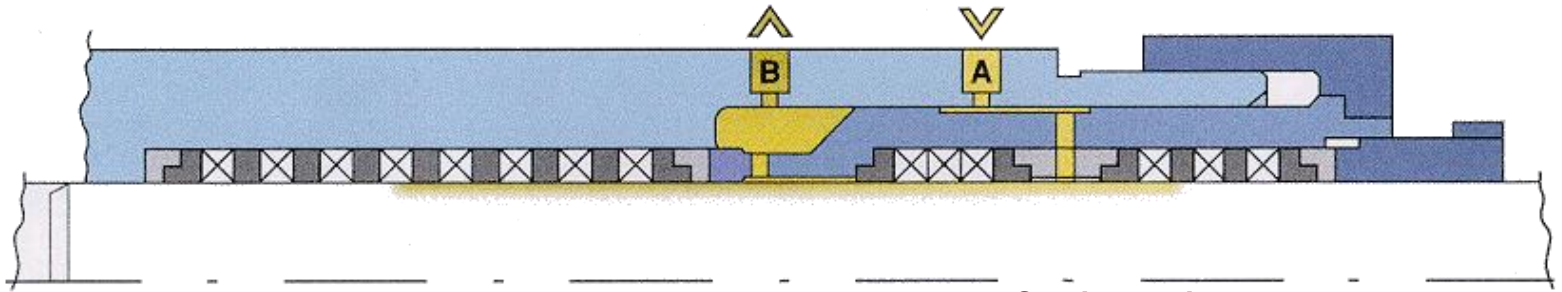
# Two (2) API 674 Quintuplex Plunger Power Pumps

- Location: Algeria Compression & Reinjection Facility
- Working fluid: Hydrocarbon Condensate, 0.49 SG
- Contaminants: Suspended solids up to 25 microns
- Suction pressure: 280 psia
- Discharge pressure: 6,000 psia
- Process temperature: 157-193°F
- 274 RPM @ 263 Hp
- Plunger average linear speed: 3.2 ft/s
- 65 GPM capacity, continuous duty



# Sealing/Packing System Design

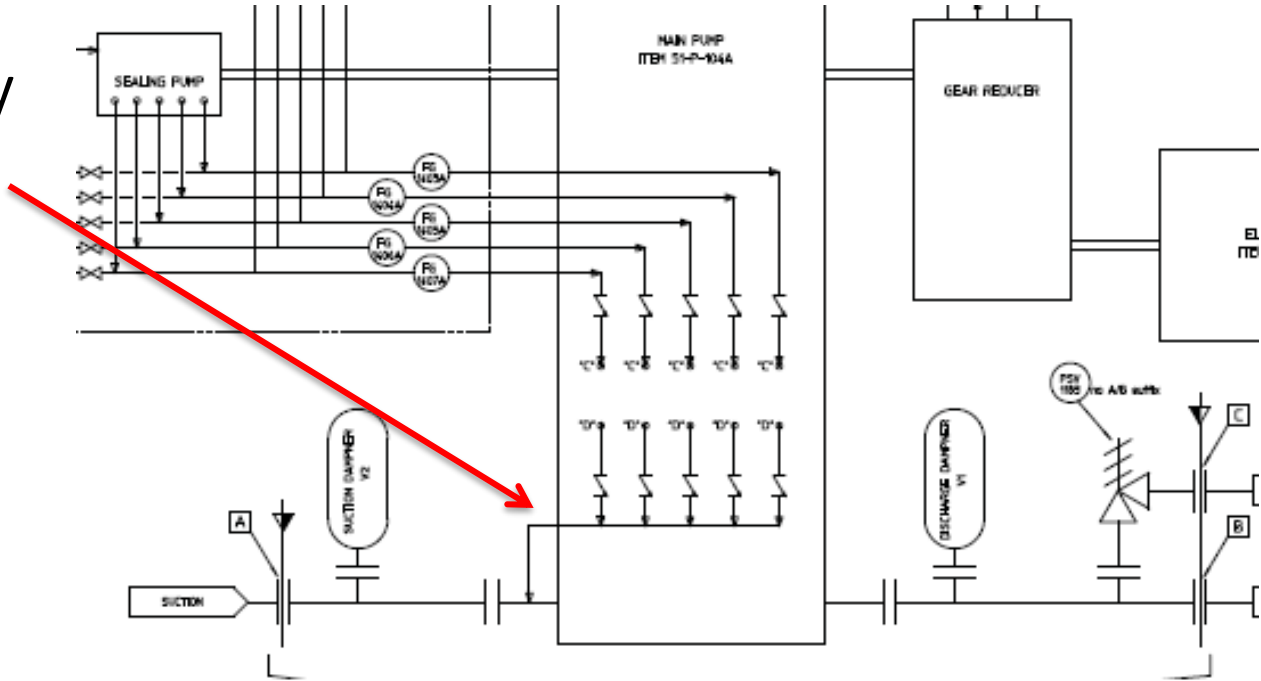
- Triple packing arrangement
- Seal oil system using mineral oil at low pressure
- Sealing oil lubricated packings and prevented emissions
- Recovery back to process fluid



A: Inlet Sealing Fluid  
B: Outlet Leakage Recovery

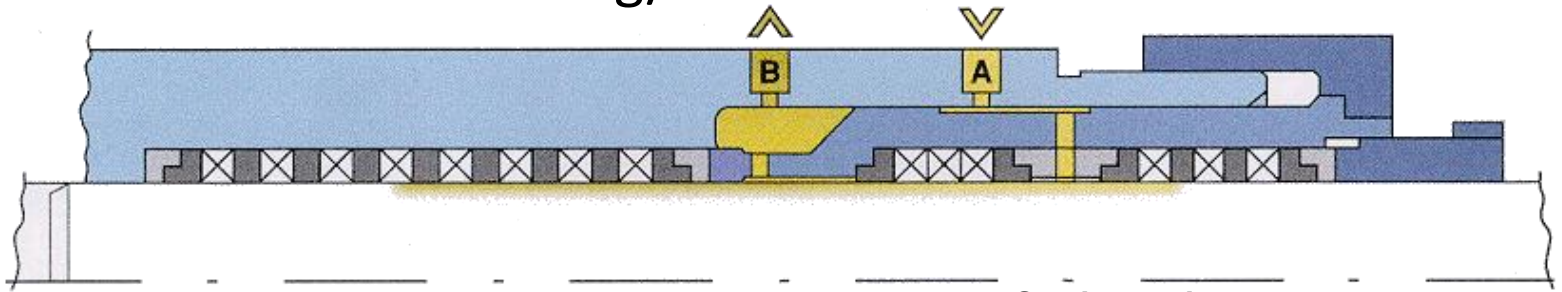
# Sealing/Packing System Design

Seal oil recovery  
back to main  
pump suction



# Packing System Failure

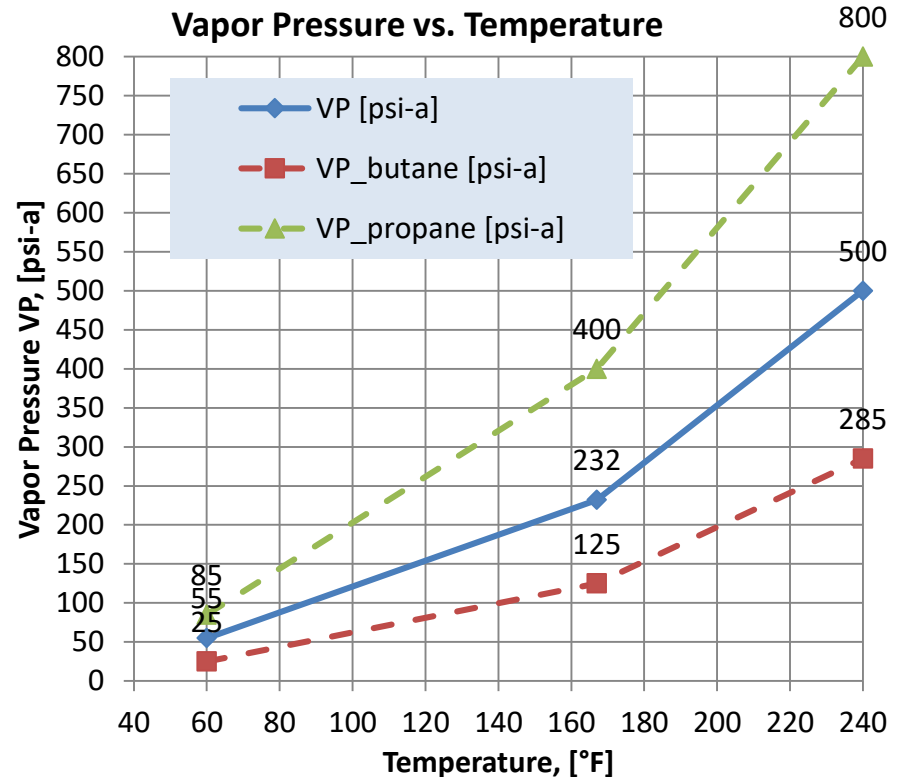
- Noticed smoke and condensate leakage from the packing area within 4 hours
- Found braided rings with white and yellow color
- Carbograpthite coating completely burned away
- Hypothesized that condensate was unstable and created a vapor condition in the sealing/lubrication fluid



A: Inlet Sealing Fluid  
B: Outlet Leakage Recovery

# Process Fluid Instability

- Vapor pressure within operating range
- Temperature rose to 201°F from packing friction
- Consequent vapor pressure rise...led to cavitation

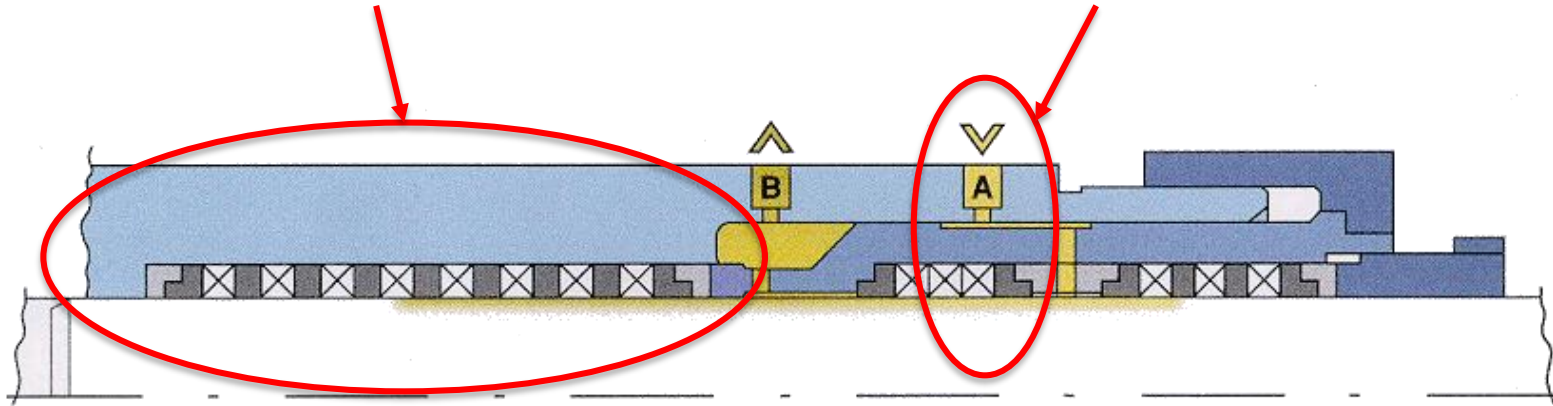




# Seal Oil System Problems

Process fluid drops  
vaporized in this region

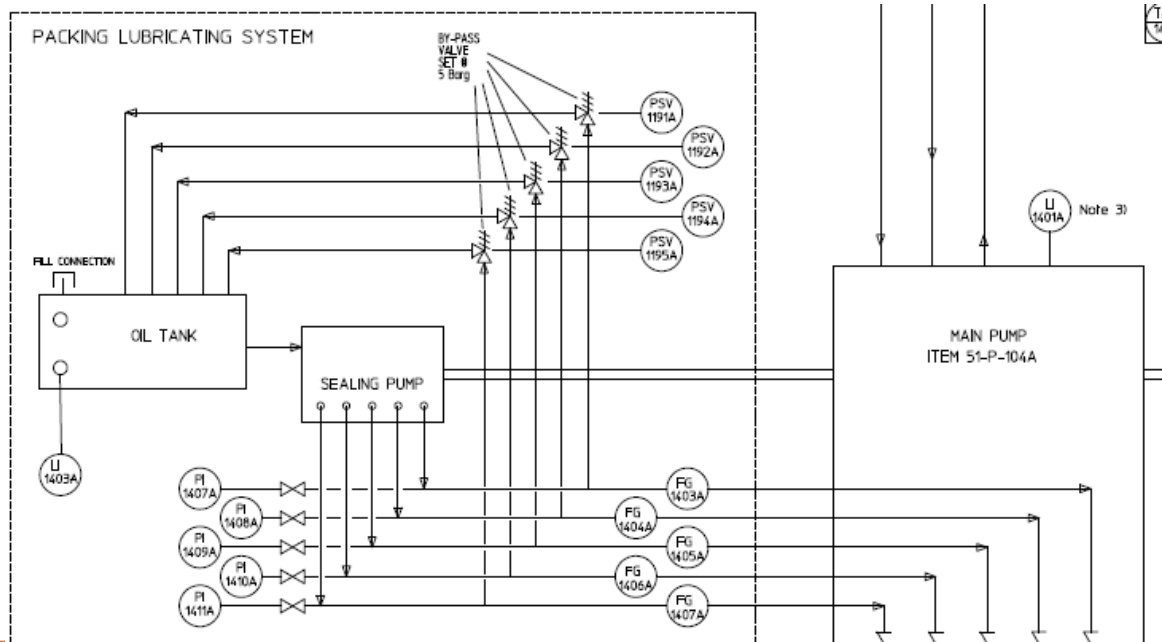
Low seal pressure allowed  
migration of process fluid  
into packing



**A: Inlet Sealing Fluid**  
**B: Outlet Leakage Recovery**

# Seal Oil System Modifications

- Changed seal pressure from 70 psig to 7 psid over suction pressure: eg. 280 psig + 7 psid = 287 psig seal oil pressure
- Created independent system



# Packing Material Upgrades

INITIAL



Aramid PTFE yarn  
Graphite PTFE yarn  
PTFE  
Silicone oil

NEW

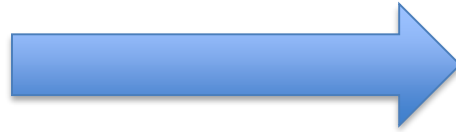


Aramid yarn  
PTFE yarn  
PTFE resin  
Parafinic lubricant

# Plunger Material Upgrades

INITIAL COATING

HVOF Colmonoy  
750-900 HV



NEW COATING

HVOF Tungsten Carbide  
1100-1300 HV

Increase reliability...prevent future problems



# Conclusions

- Cavitation = instability...vaporized fluid entered the packing region of the pump
- Cavitation = instability...vaporized fluid removed lubricants from packing yarns caused overheating
- Less packing lubrication = increased likelihood of scratches and damages to the plunger



# Lessons Learned – New Parameters

- Avoid cavitation at all costs
- Increase seal oil pressure to reduce risk of vaporization
- Provide packing with additional lubricant features
- Special plunger coating for hydrocarbon condensate services

