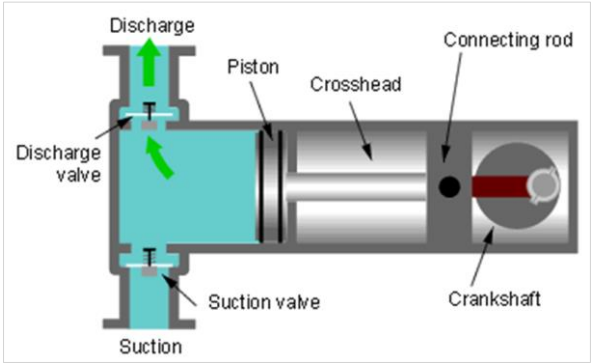
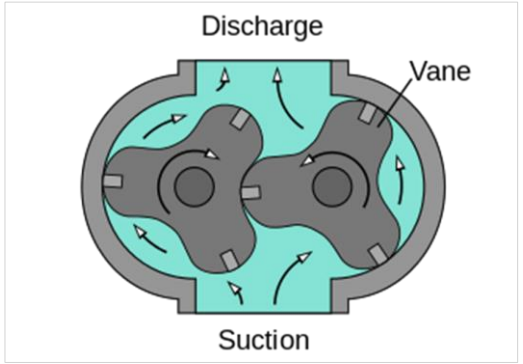
PUMPS

Centrifugal Pump

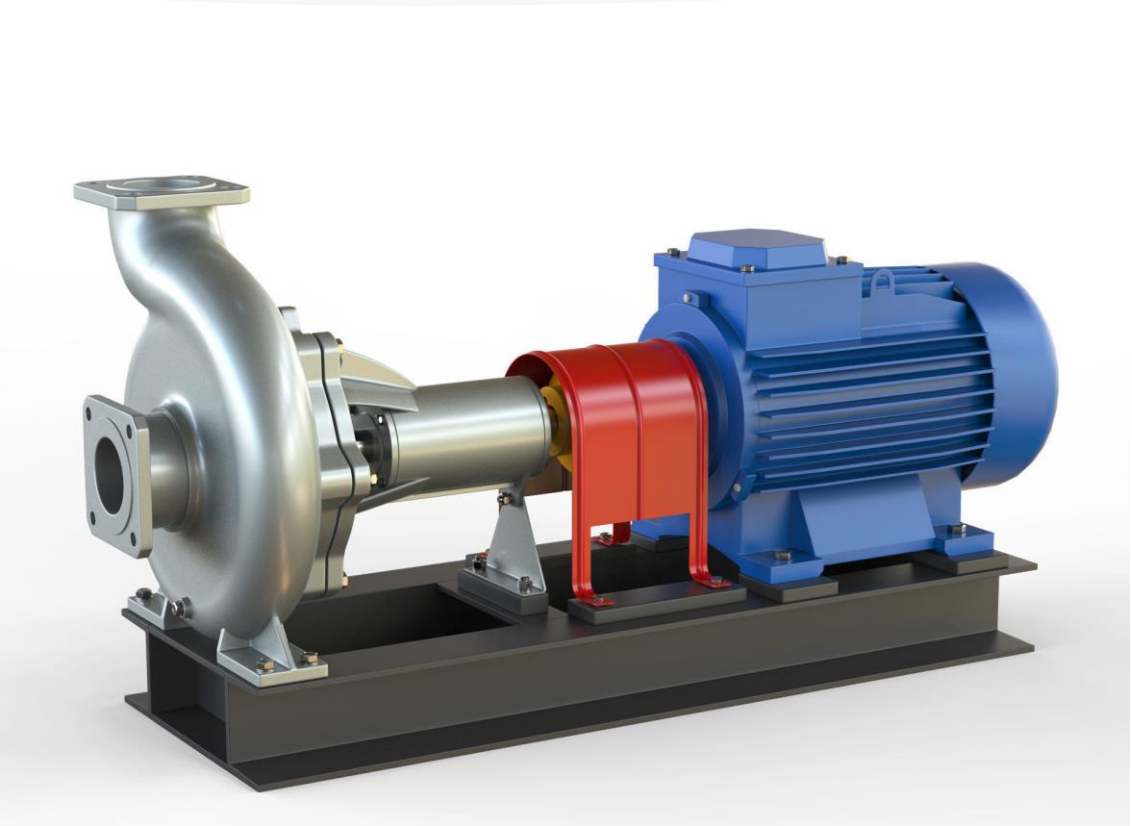
PD Pump - Reciprocating



PD Pump - Rotary



CENTRIFUGAL



Asset Overview:

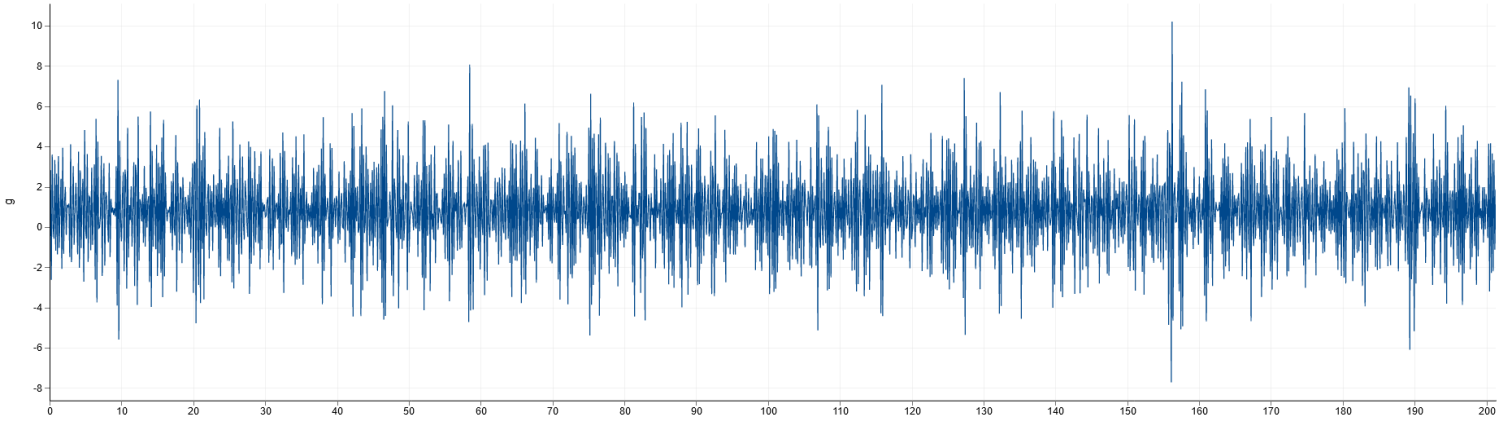
- Centrifugal pumps are a type of machine used for moving fluid by transferring rotational energy (angular velocity of motor) into fluid flow
- ALL centrifugal pumps have an impeller and impeller casing

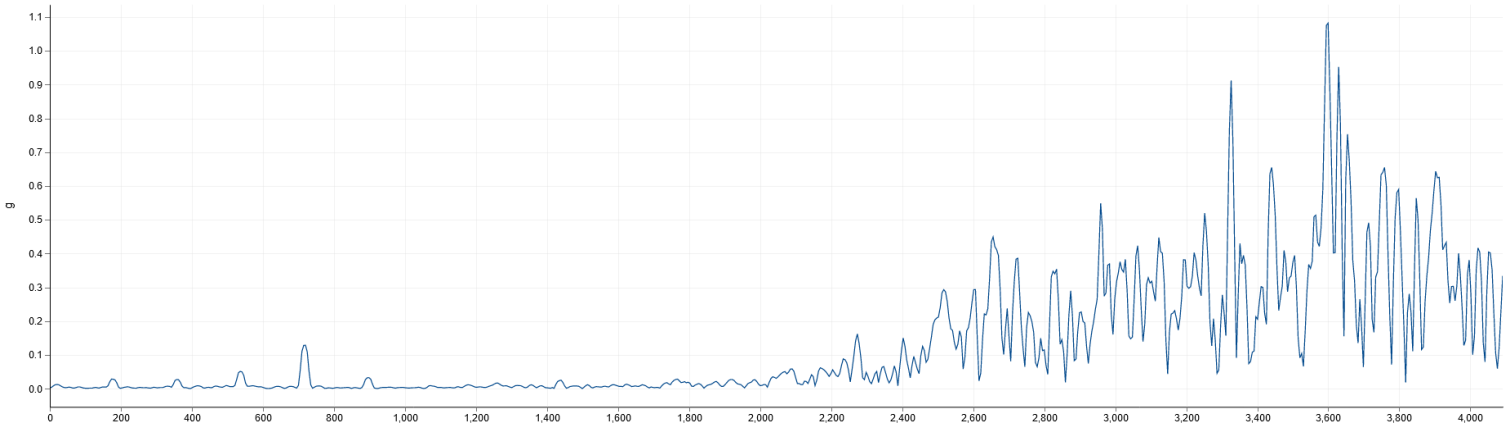
Common Failure Modes:

- Cavitation
- Impeller Wear
- Bearing Fault

CENTRIFUGAL

Fault Type 1: Cavitation





Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range

Recommendations:

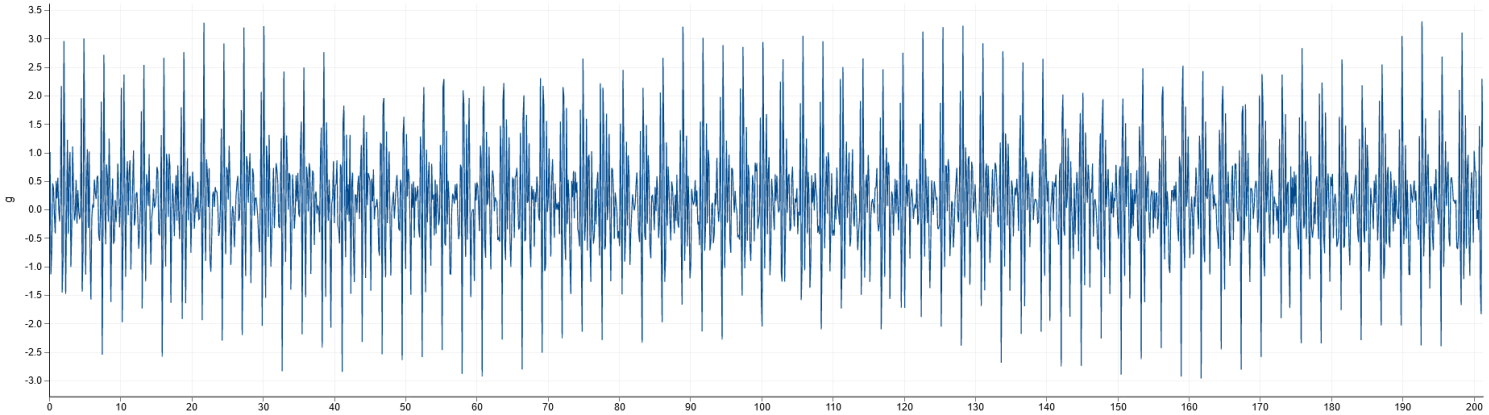
- Replace/rebuild pump

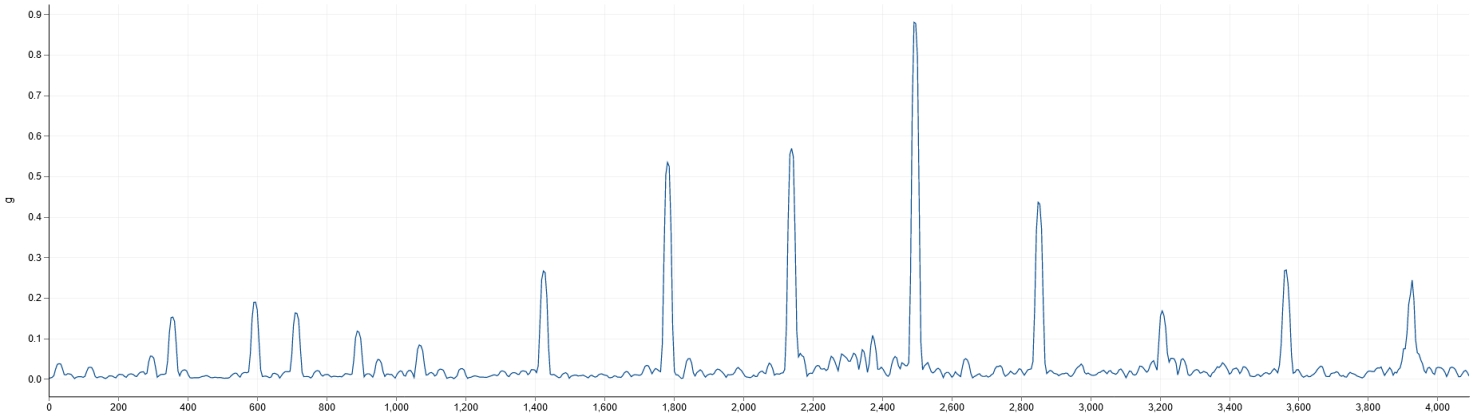
Possible Root Cause:

- Incorrect pressures; lack of flow; running away from BEP

CENTRIFUGAL

Fault Type 2: Impeller Wear





Time Waveform:

- Impacting spaced at vane pass freq.

Frequency Spectrum:

- Strong harmonics of the vane pass freq.

Recommendations:

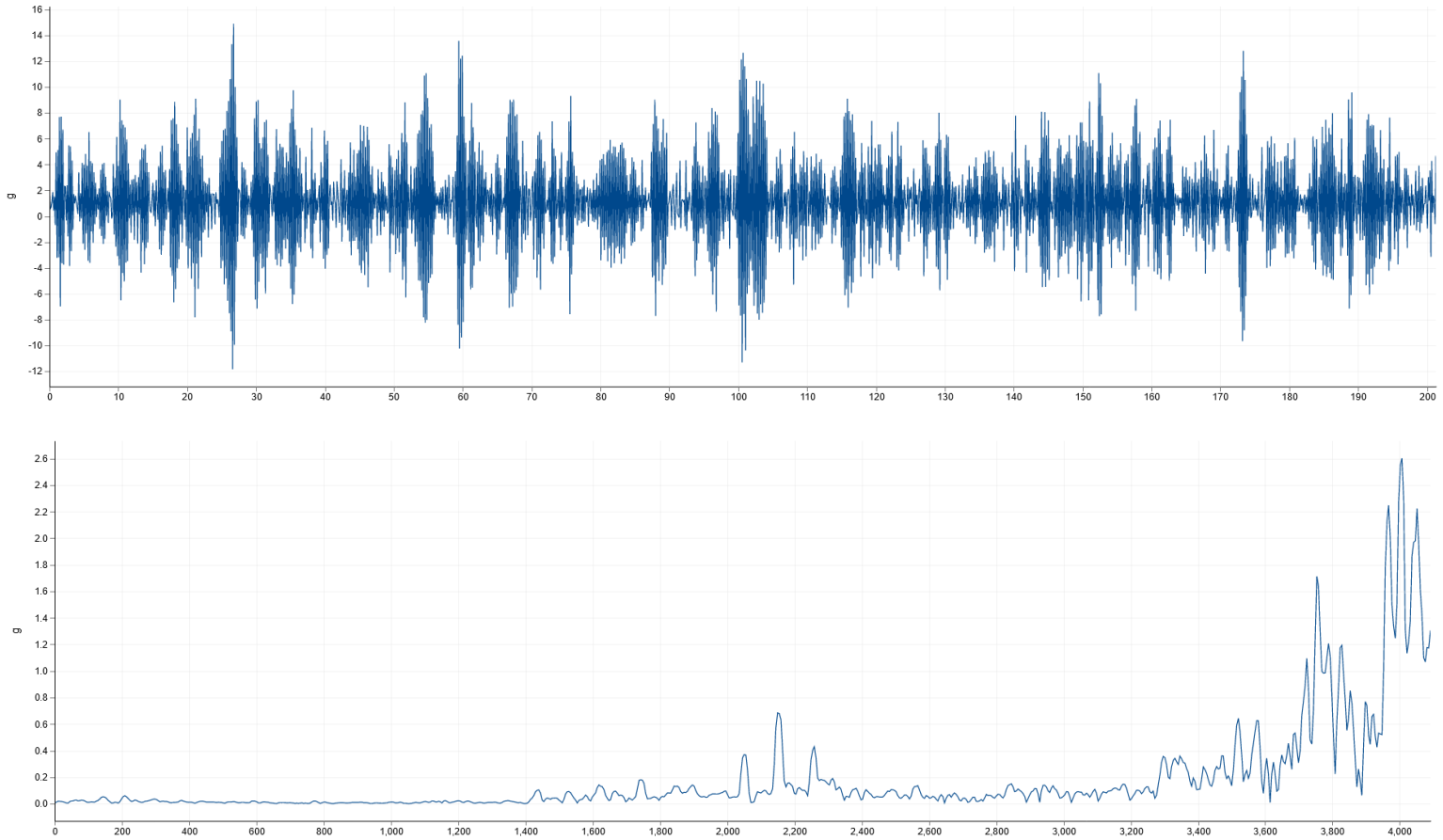
- Pump replacement; impeller repair

Possible Root Cause:

- Lack of flow; operating away from BEP

CENTRIFUGAL

Fault Type 3: Bearing Fault



Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range; strong harmonics of bearing freq.

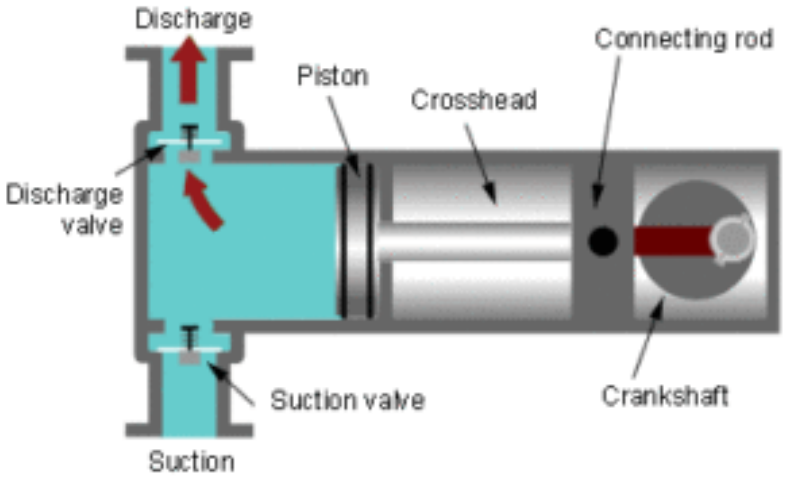
Recommendations:

- Check lubrication levels; inspect bearing (audible noises); replace bearing

Possible Root Cause:

- Over/under lubrication; ingress of debris; electric discharge

PD PUMP – RECIPROCATING



YouTube Video

Asset Overview:

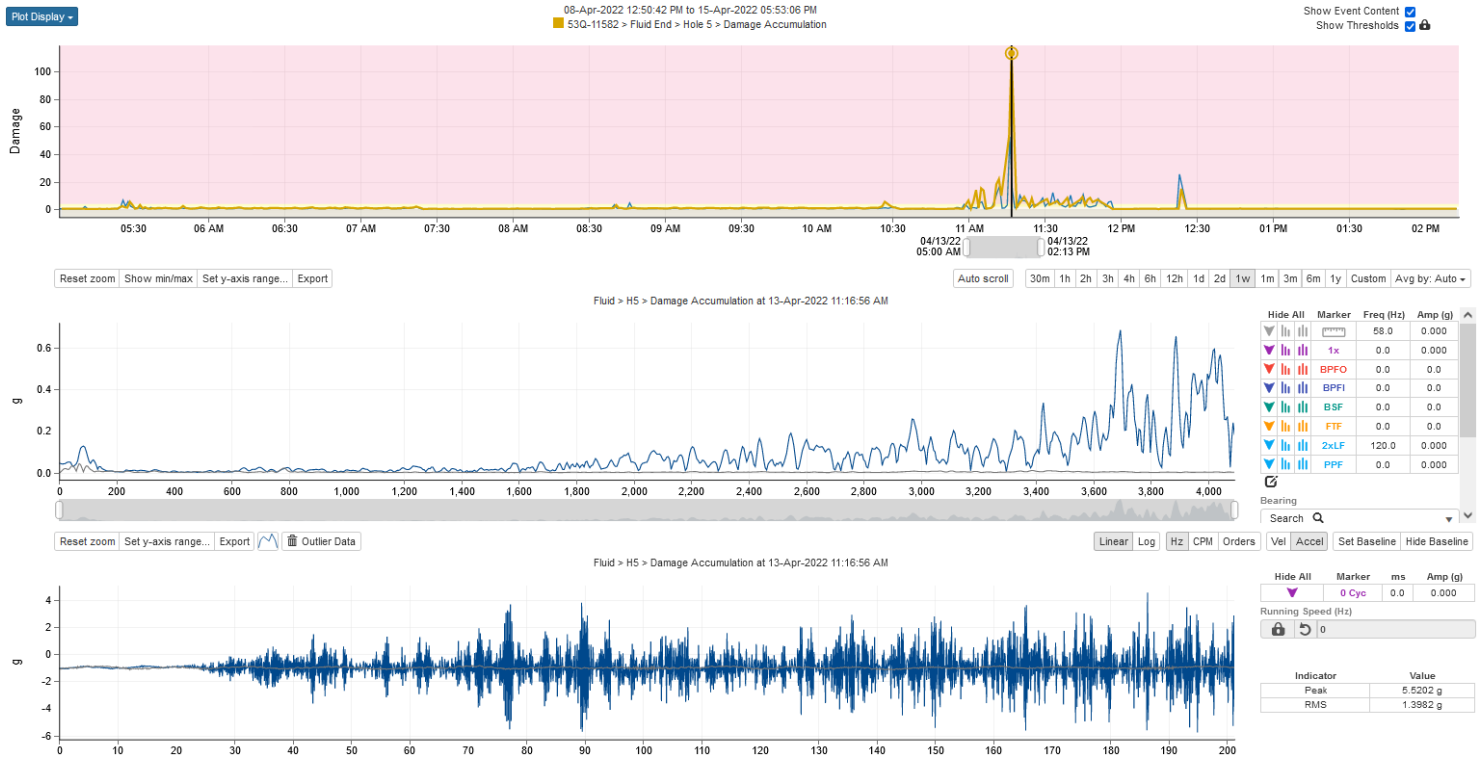
- A reciprocating positive displacement pump uses a piston moving in and out of a chamber to compress fluid.
- As the plunger moves back, the chamber pressure decreases allowing flow in the suction side.
- As it moves forward, the pressure increases out the discharge side.

Common Failures:

- Valve Failure
- Packing Failure
- Lubrication Failure
- Piston Wear

PD PUMP – RECIPROCATING (O&G)

Fault Type 1: Valve Failure



Time Waveform:

- High amplitude noise.

Frequency Spectrum:

- Dominated by high frequency noise

Recommendations:

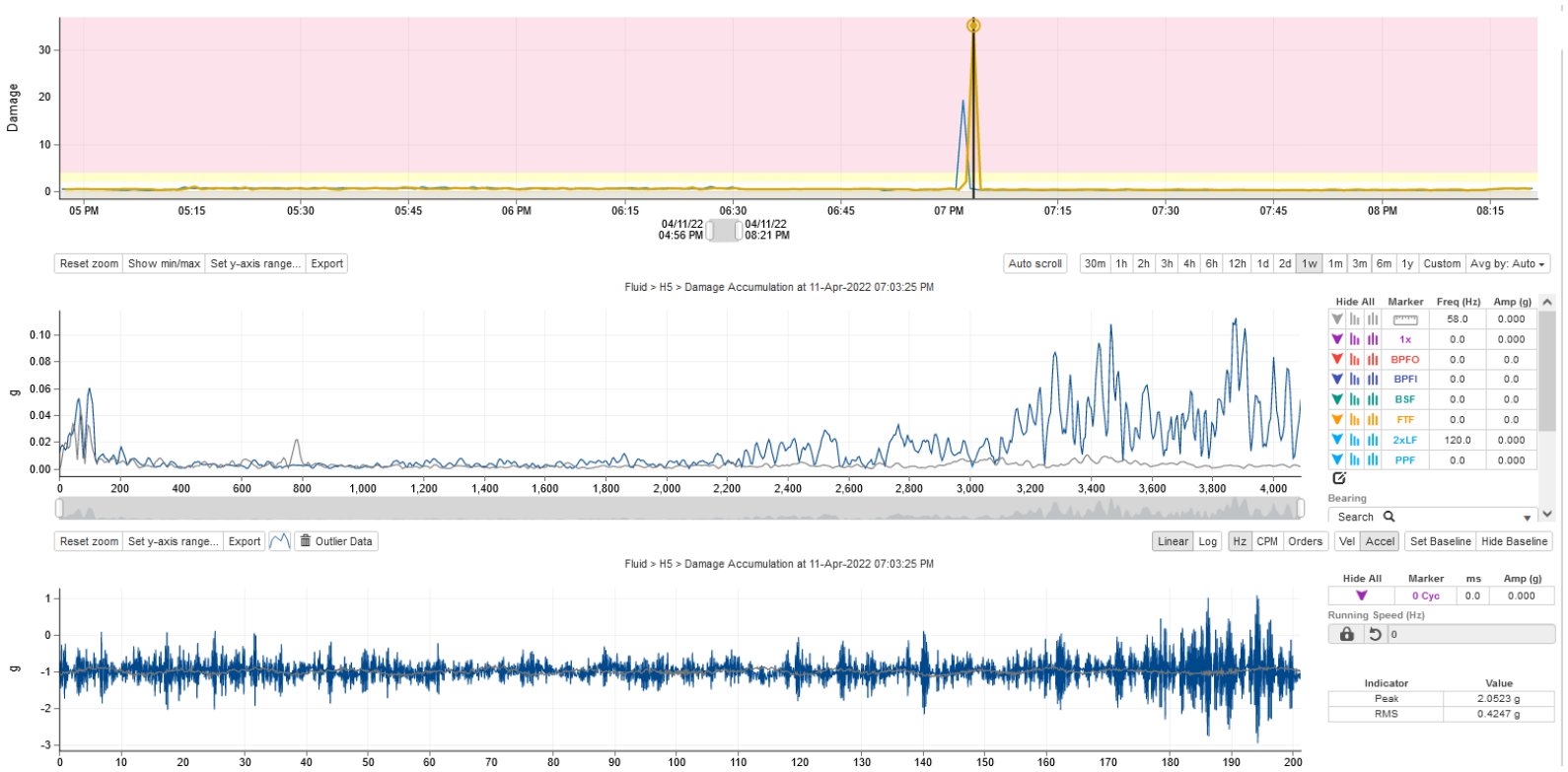
- Check valves for wear or damage

Root Cause:

- Time, typically these last about 100 hours or cavitation

PD PUMP – RECIPROCATING (O&G)

Fault Type 2: Packing Failure



Time Waveform:

- Similar pattern to Valve, but typically lower amplitude and shorter

Frequency Spectrum:

- High frequency noise

Recommendations:

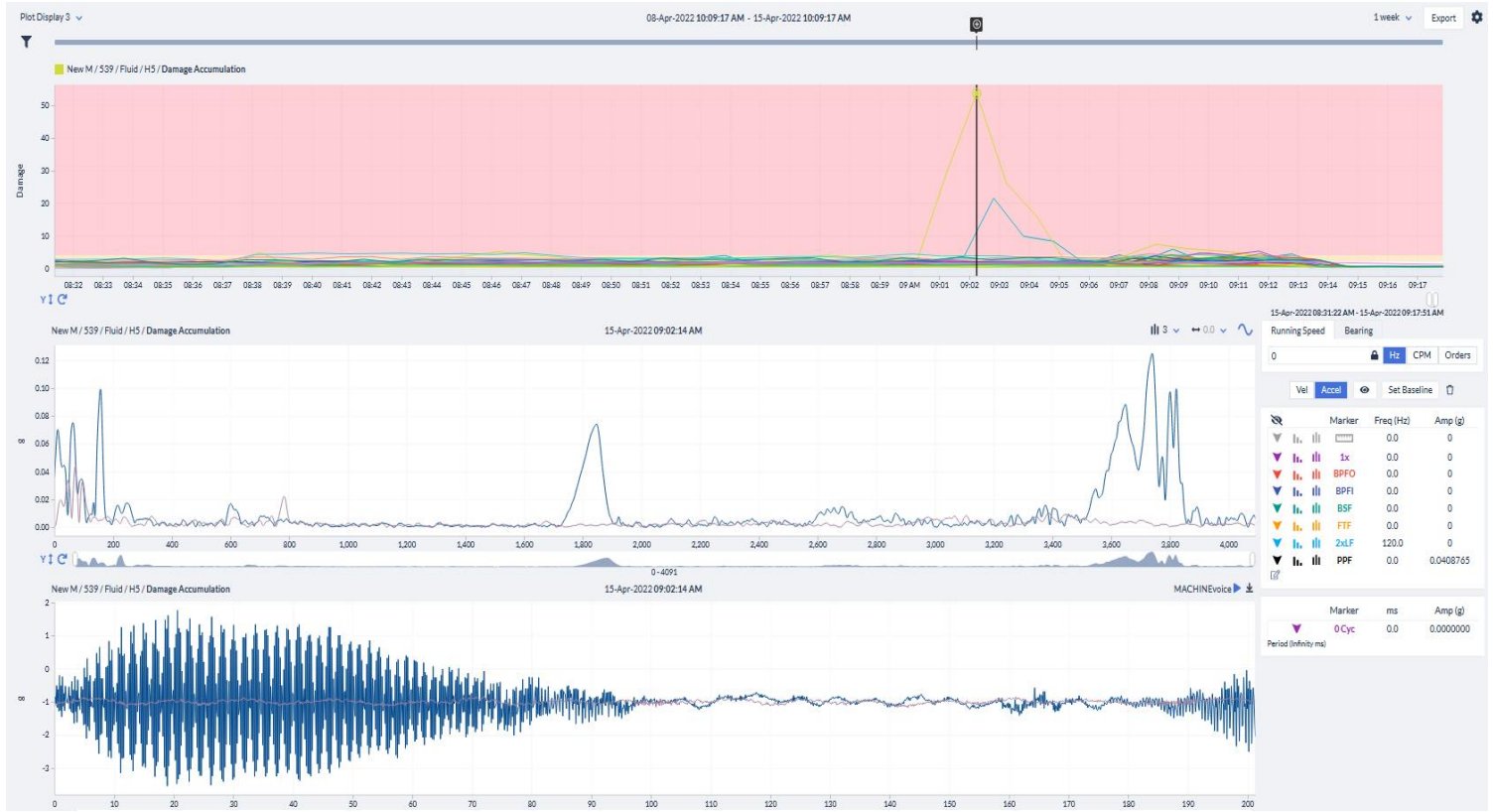
- Check for fluid spraying out the back

Root Cause:

- Time or poor lubrication

PD PUMP – RECIPROCATING (O&G)

Fault Type 3: Lubrication Failure



Time Waveform:

- Football shape

Frequency Spectrum:

- Distinct peaks in the 3,000hz range

Recommendations:

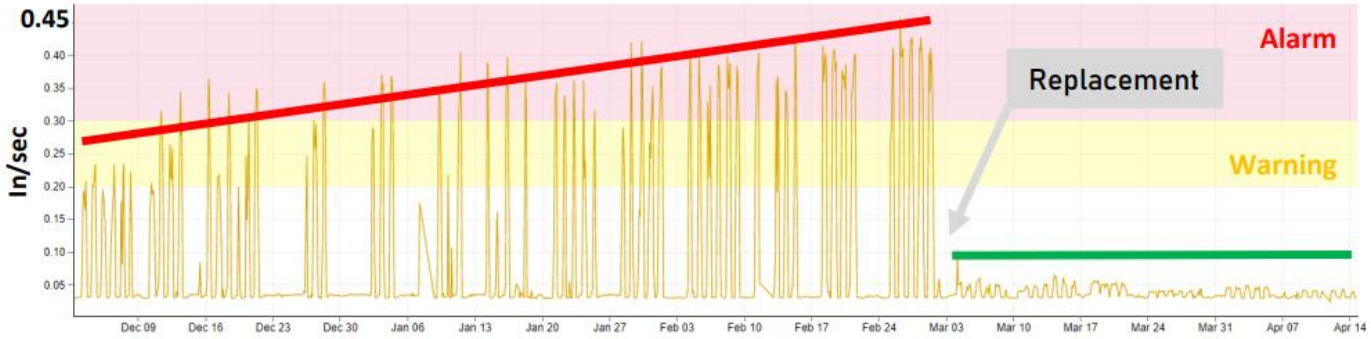
- Check for non-functioning grease lines or burnt grease

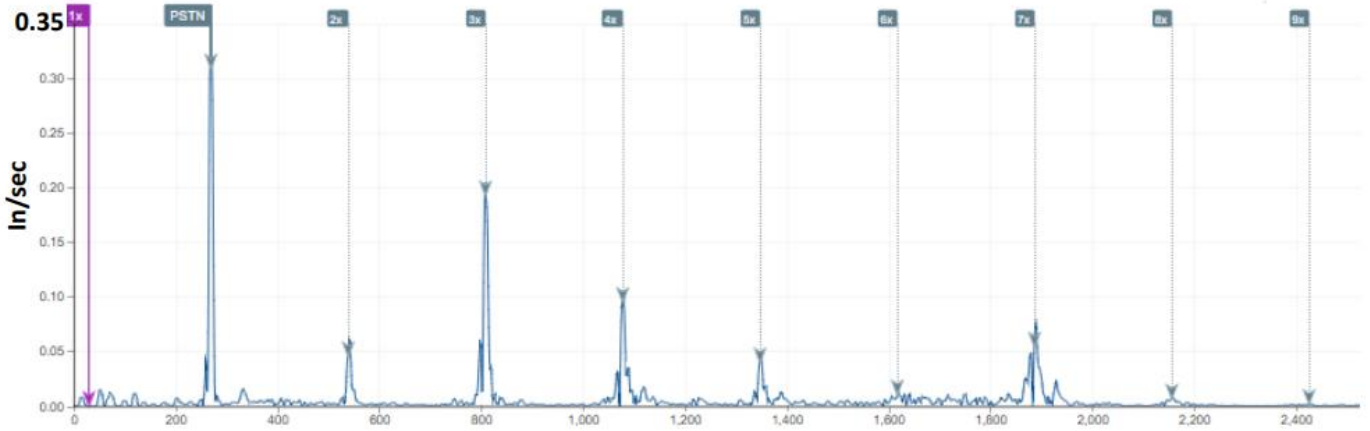
Root Cause:

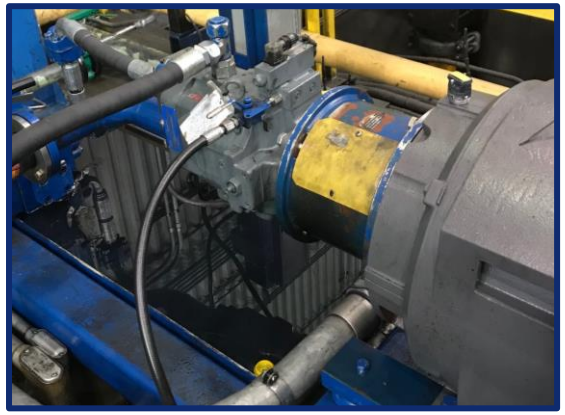
- Clogs, lack of grease, wrong kind of grease, not enough grease

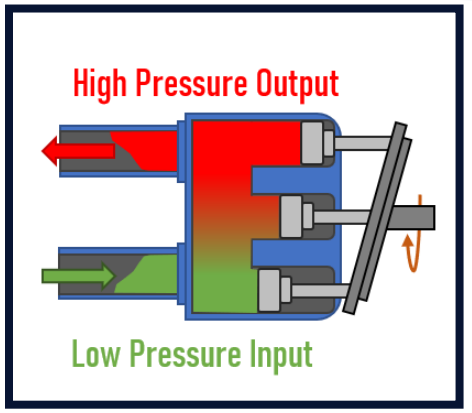
PD PUMP – RECIPROCATING (IND.)

Fault Type 1: Piston Wear









Frequency Spectrum:

- Shows piston pass frequency with harmonics indicating elevated wear on pistons

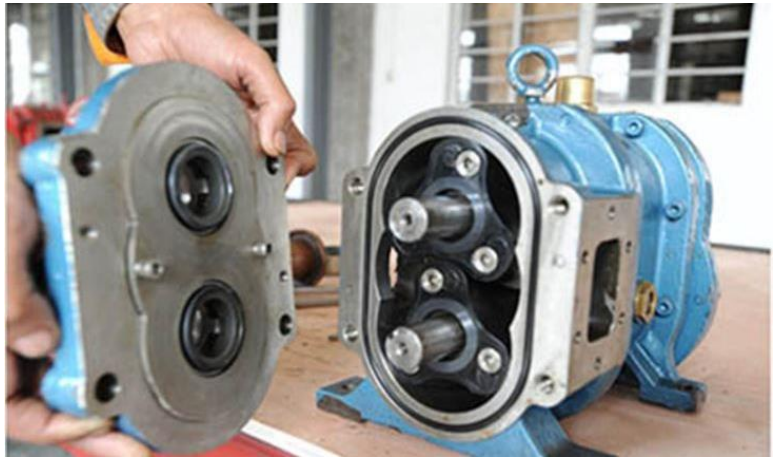
Possible Causes of Piston Wear:

- Improper installation and maintenance practices, wear due to debris, imbalance, misalignment, improper piping design, cavitation

Recommendations/Questions to Ask:

- When was the last time this pump was replaced?
- What are the typical failure modes that you see on these pumps?
- What fluid runs through the pump?
- Have you seen wear on these pumps previously?
- Recommend replacing the pistons or pump depending on size and severity of condition

PD PUMP – ROTARY



Asset Overview:

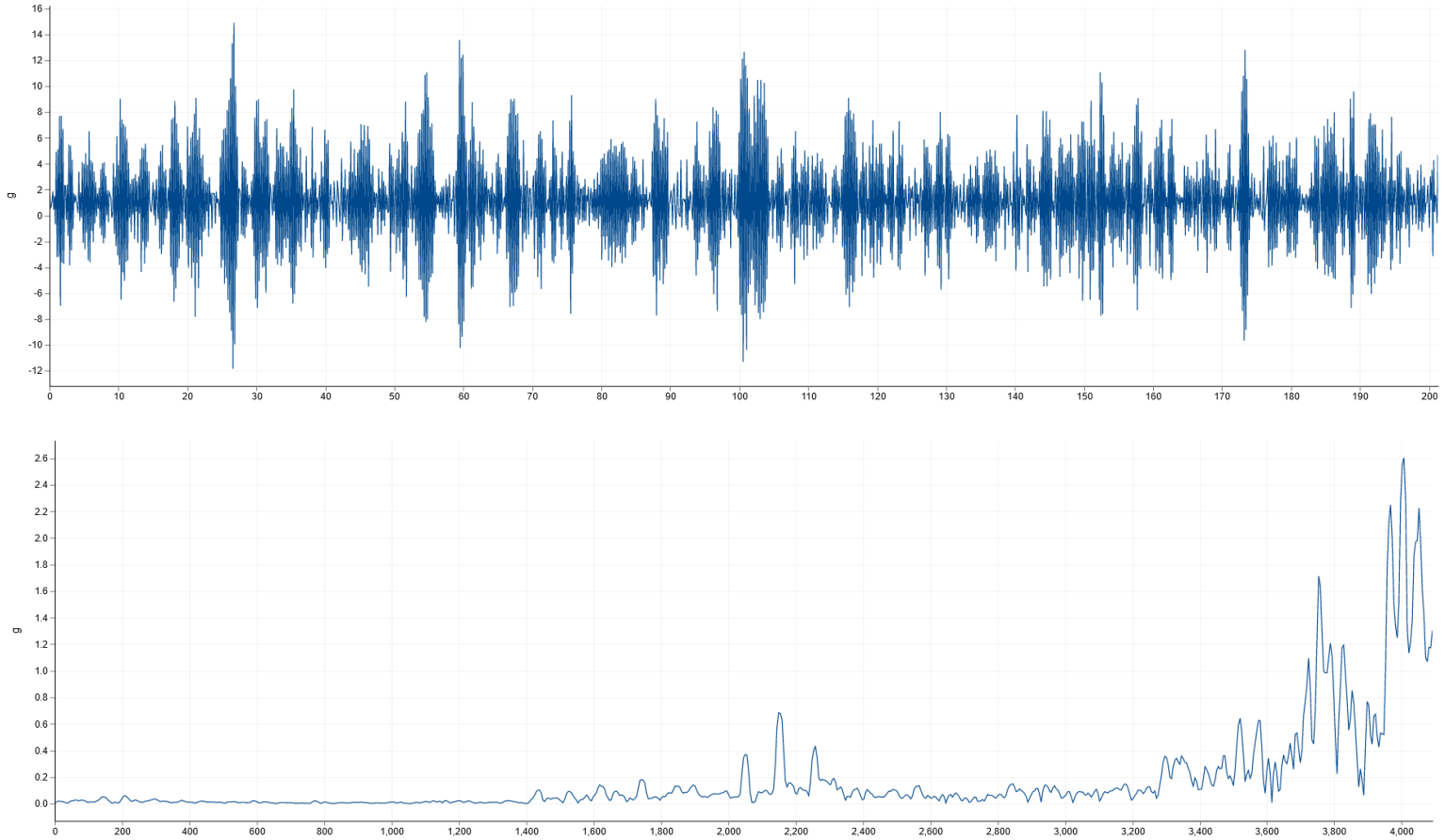
- A positive displacement rotary pump uses rotational energy to move fluid in a consistent matter (constant flow rate)
- Pressure in a PD pump can be varied while flow is held constant making it a useful pump in variable flow situations

Common Failure Modes:

- Bearing Fault
- Lobe Wear
- Cavitation

PD PUMP – ROTARY

Fault Type 3: Bearing Fault



Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range; strong harmonics of bearing freq.

Recommendations:

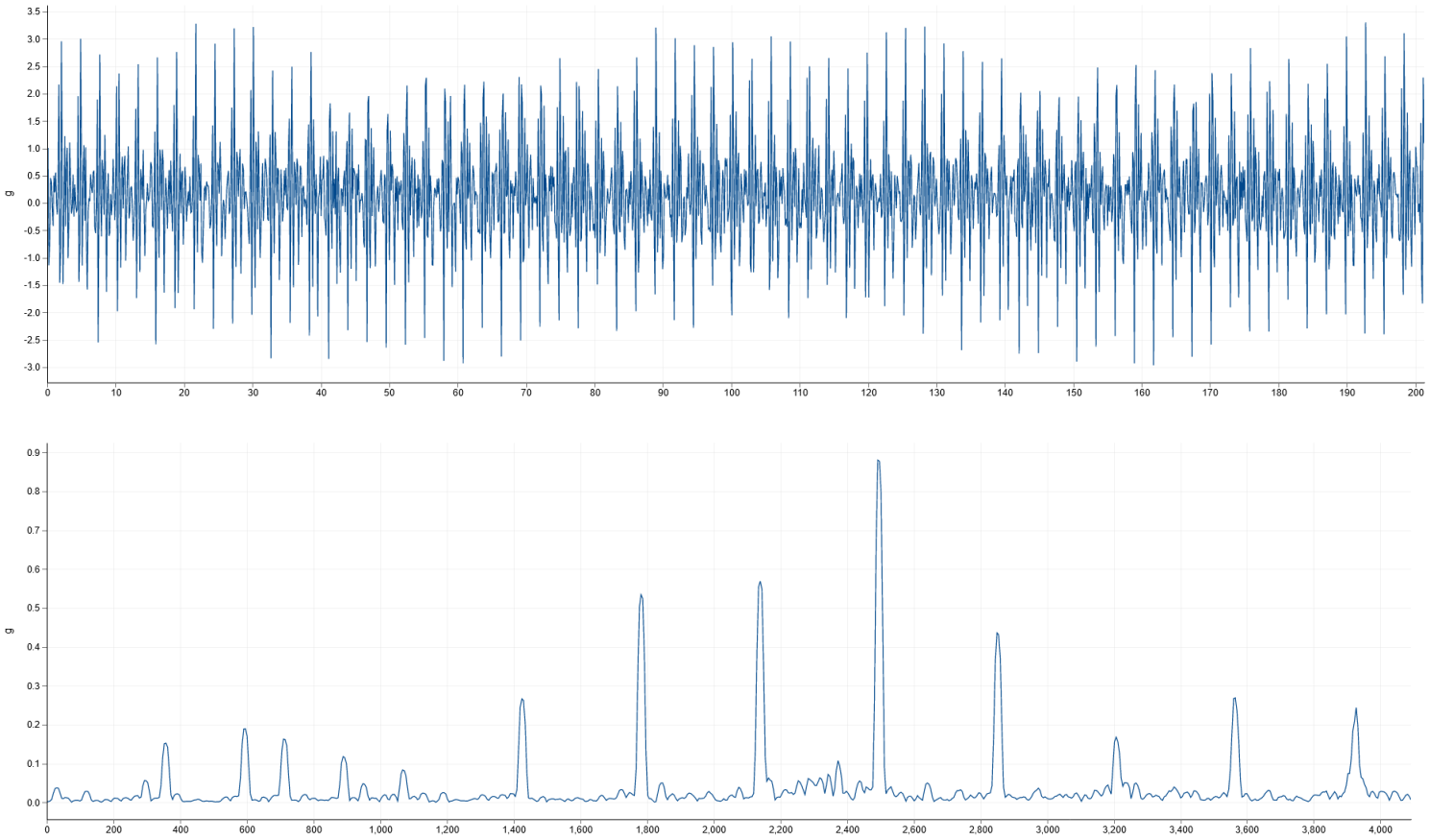
- Check lubrication levels; inspect bearing (audible noises); replace bearing

Possible Root Cause:

- Over/under lubrication; ingress of debris; electric discharge

PD PUMP – ROTARY

Fault Type 2: Lobe Wear



Time Waveform:

- Impacting spaced at vane pass freq.

Frequency Spectrum:

- Strong harmonics of the vane/lobe pass freq.

Recommendations:

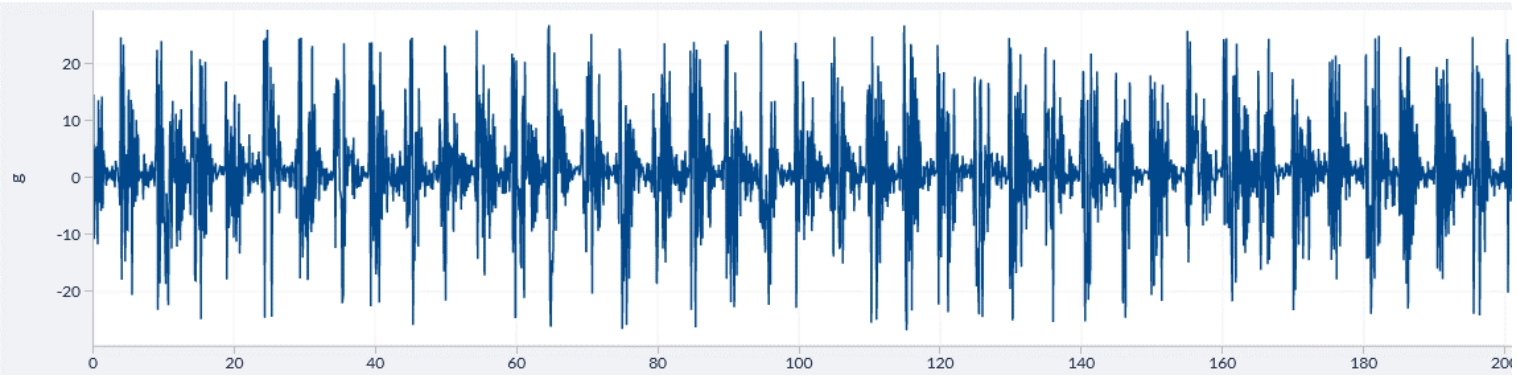
- Pump replacement; lobe replacement/repair

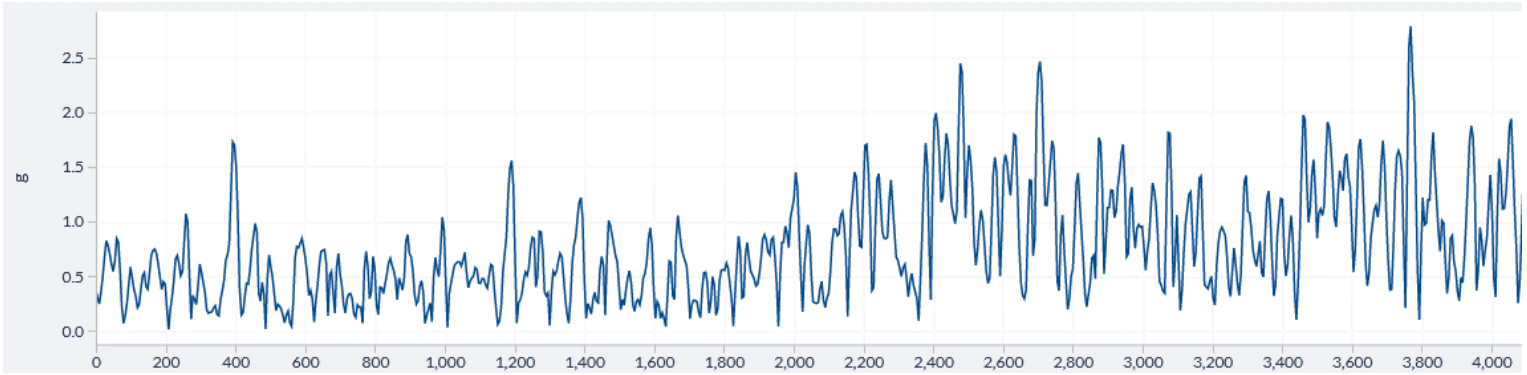
Possible Root Cause:

- Lack of flow; operating away from BEP

PD PUMP – ROTARY

Fault Type 3: Cavitation





Time Waveform:

- Sharp, non-synchronous impacting

Frequency Spectrum:

- High frequency noise; elevated noise floor in higher freq. range

Recommendations:

- Replace/rebuild pump

Possible Root Cause:

- Incorrect pressures; lack of flow; running away from BEP

