



The Eight Application Pillars of Ultrasound

Condition Monitoring for the Masses

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SDT Ultrasound Solutions



Mission

*Provide Solutions That Give our Customers a Better Understanding About the
Reliability of their Assets*



PARTNERED ULTRASOUND

Reliability Partner

Vision:

To Help Advance Industry Toward

- ZERO Accidents
- ZERO Downtime
- ZERO Waste



ZERO Accidents

Police

Firefighter

Maintenance

Workplace Fatalities in the USA - 2016

127

35

470

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Zero Accidents

Safety and Reliability

Dupont reported that the most likely person to be injured is:

- A maintenance technician
- With less than 2 years experience
- Doing reactive work



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Particularly Perilous Period

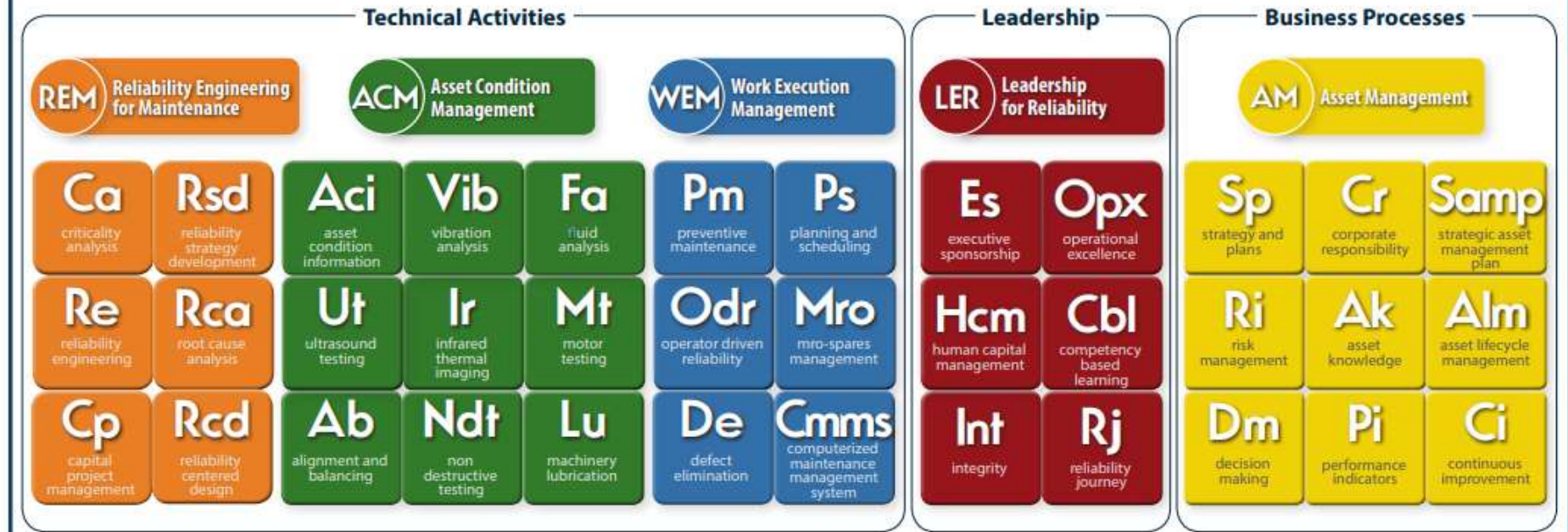


Source: Tame Your Transient Operations by Scott W. Ostrowski and Kelly K. Keim, ExxonMobil Chemical Company June 2010

- ZERO Accidents
 - ZERO Downtime
- # Unplanned

Aligned to a Holistic Reliability Framework

Uptime® Elements™



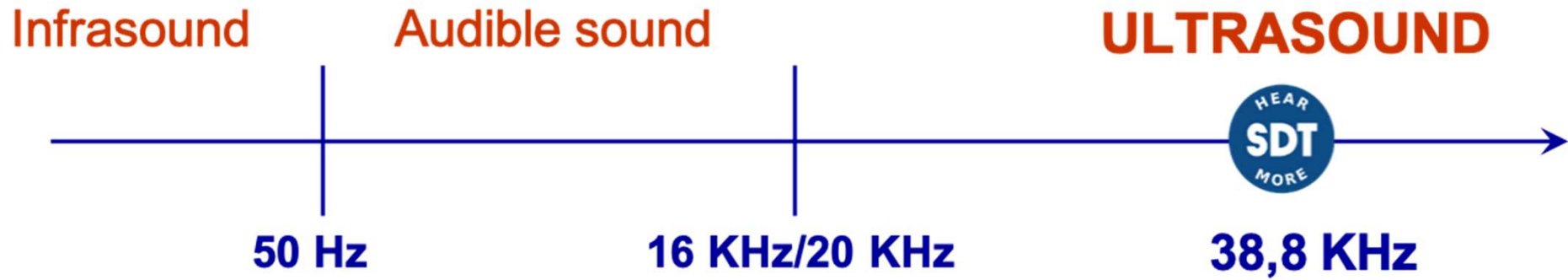
A Reliability Framework and Asset Management System™



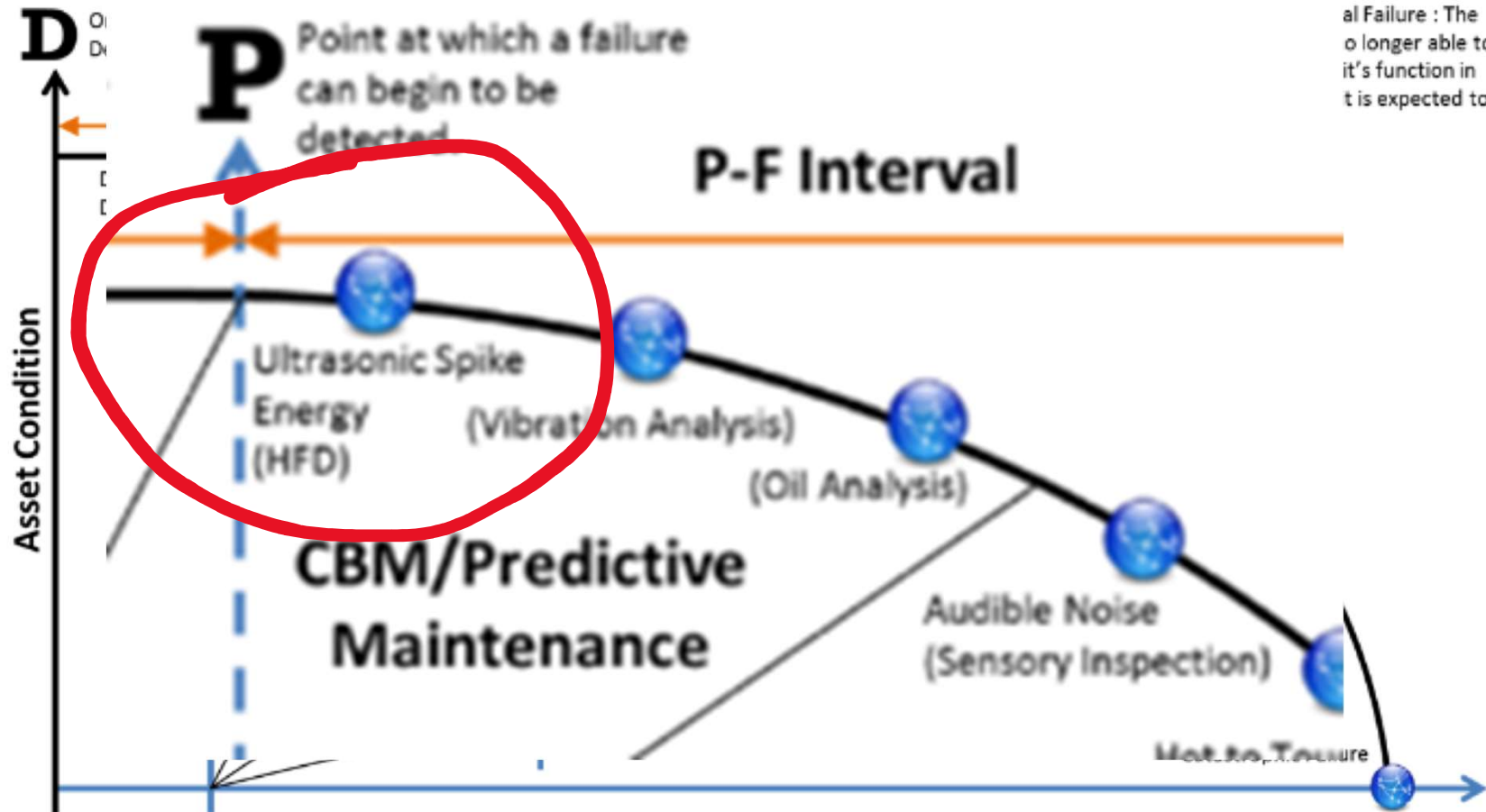
Ultrasound



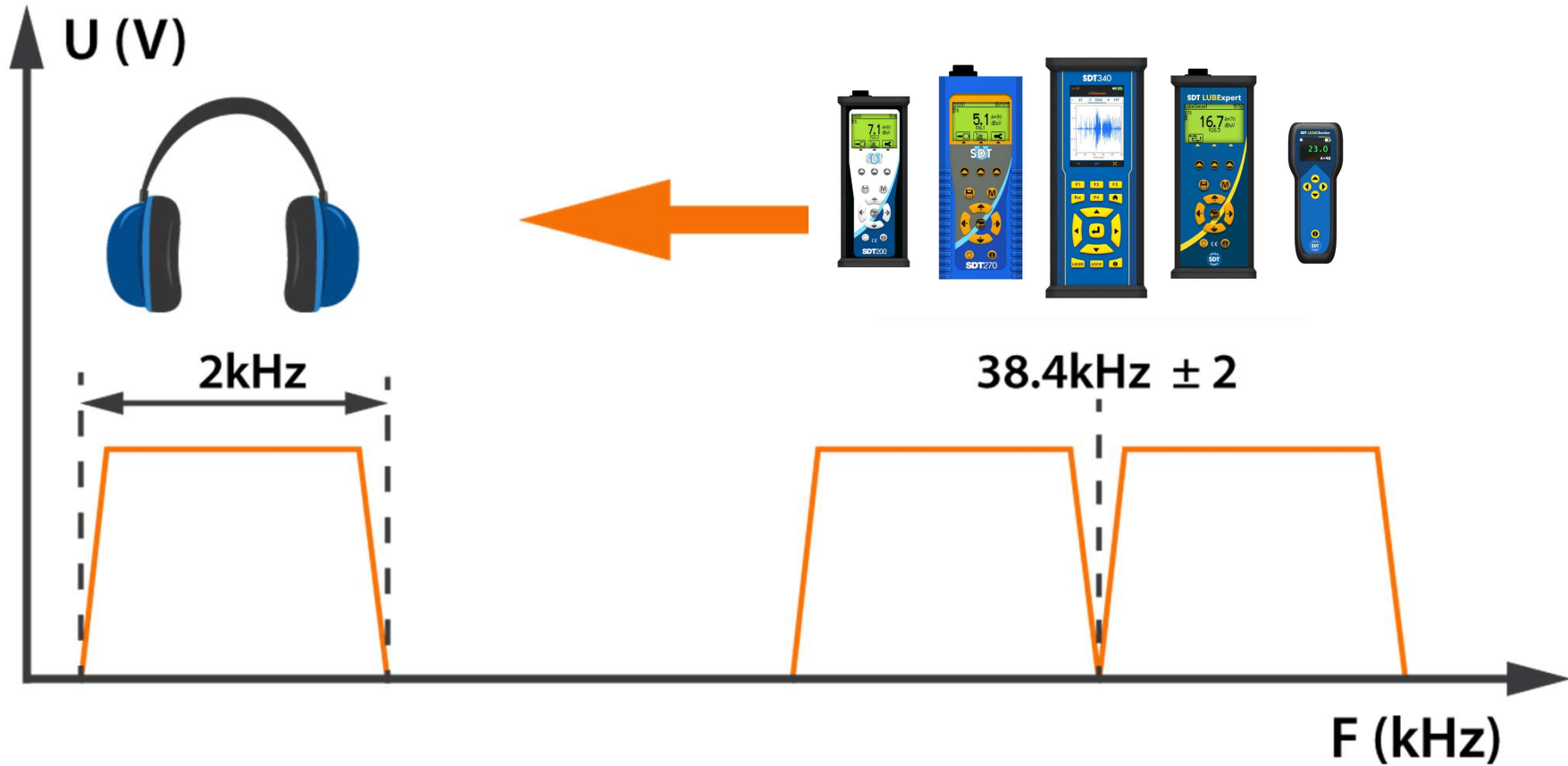
What is Ultrasound?



Ultrasound Owns the Apex of the P-F Curve



Ultrasound











Ultrasound as a Measure of FITness

F R I C T I O N
I M P A C T I N G
T U R B U L E N C E

The Eight Application Pillars

APPLICATIONS

MECHANICAL	LEAKS	LUBRICATION	ELECTRICAL	VALVES	STEAM	HYDRAULICS	TIGHTNESS
 Detect defects in any mechanical system .	 Find pressure and vacuum leaks in noisy conditions	 Avoid over/under lubrication. Grease bearings right.	 Inspect medium and high voltage systems for arcing, tracking and corona.	 Asses valve tightness	 Find faulty steam traps and leaking components	 Troubleshoot any hydraulic system for passing and blockages.	 Determine the tightness of any enclosed volume

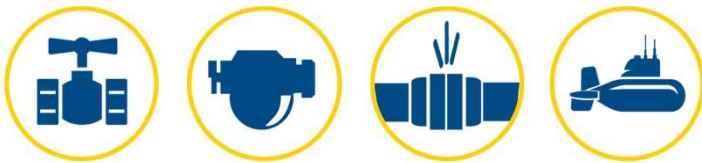
Zero Waste



Zero Accidents



Zero Downtime





Mechanical

- Rotating
- Non-rotating

- Gearbox/Reducers
- Chain/Belt/Coupled Drives

- Cavitation

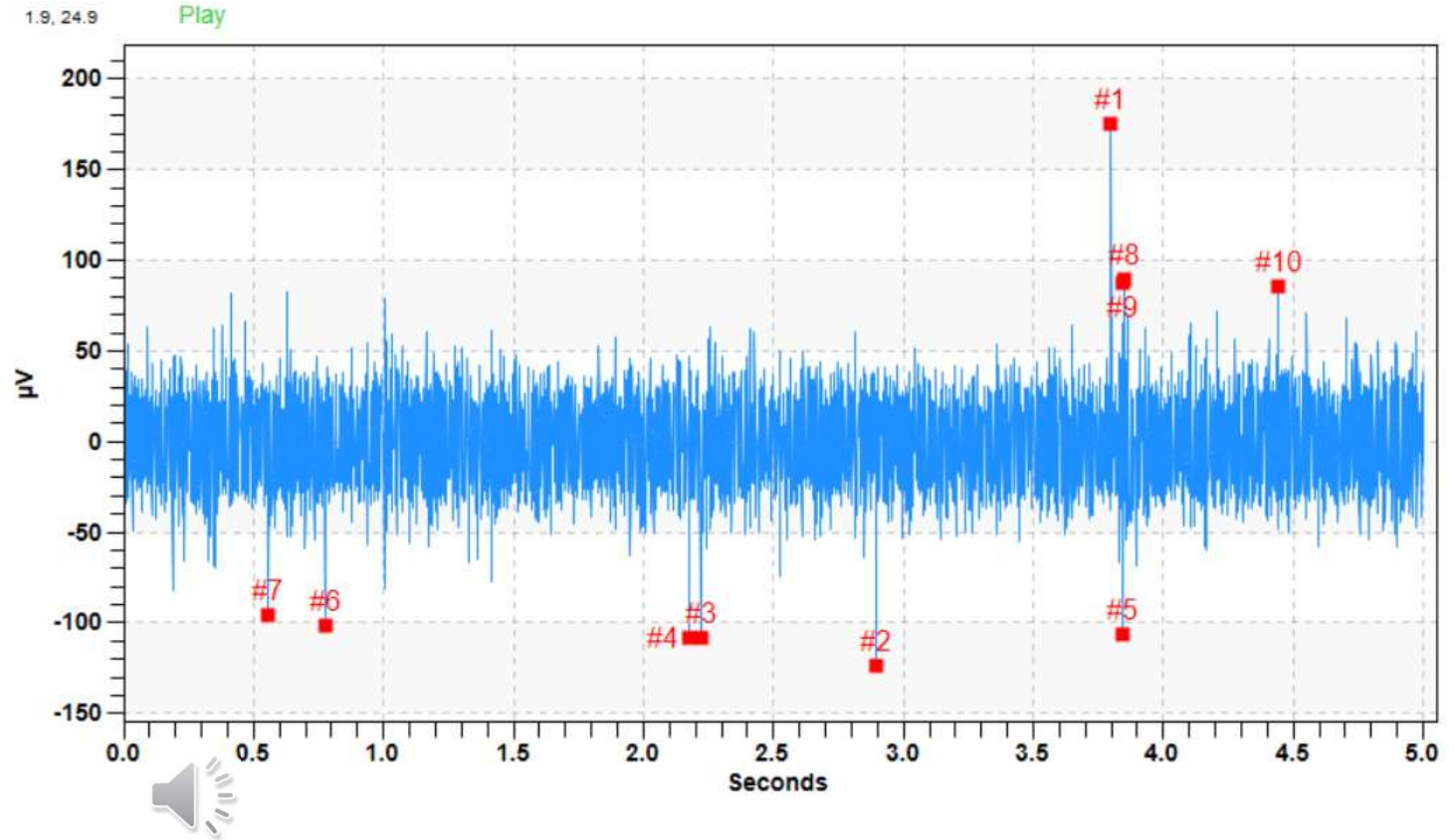
- Friction?
- Impacting?
- Turbulence?





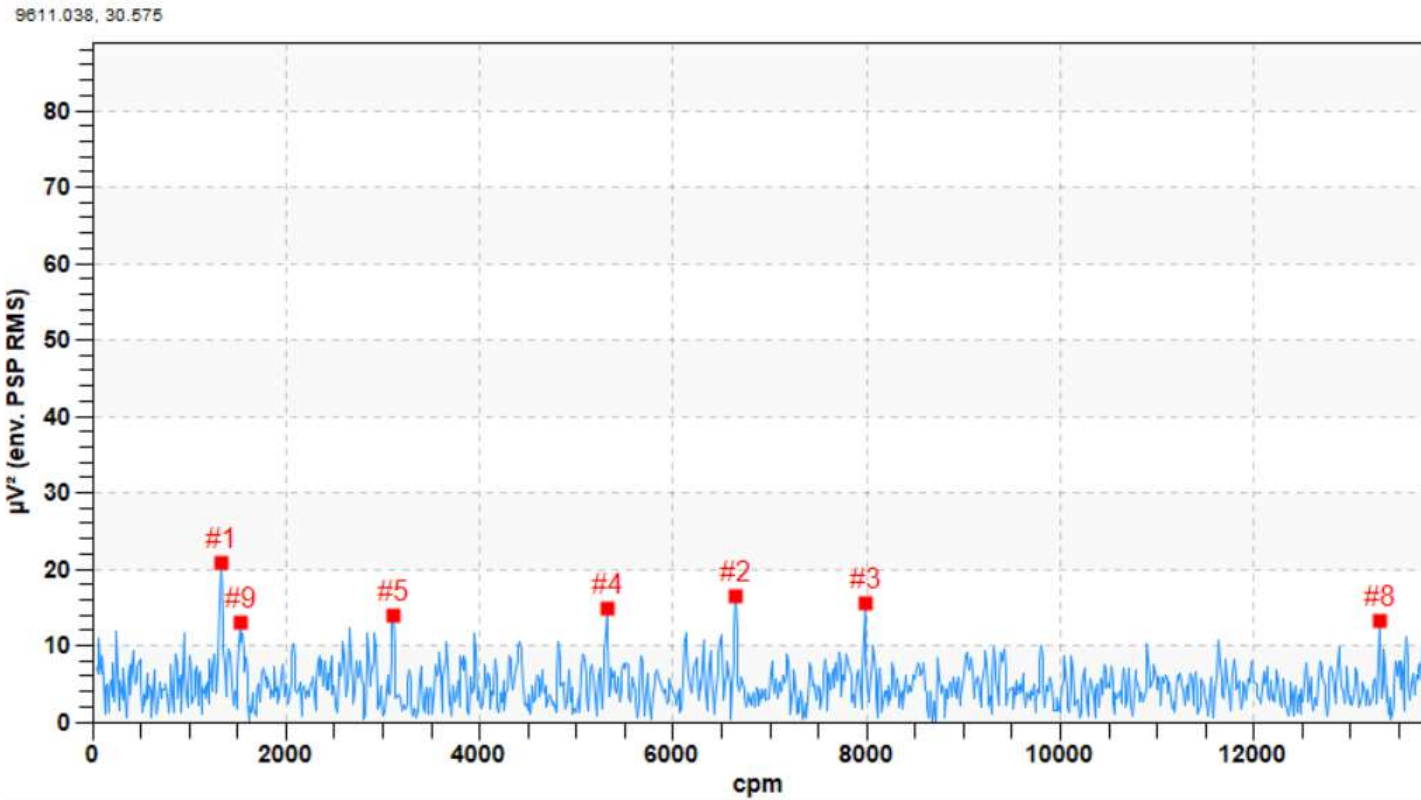
Mechanical - Coupling Inspection

- **October 2018**
 - Moderate Friction





Mechanical - Coupling Inspection



Highest Peaks

Sorted by energy

Sorted by frequency

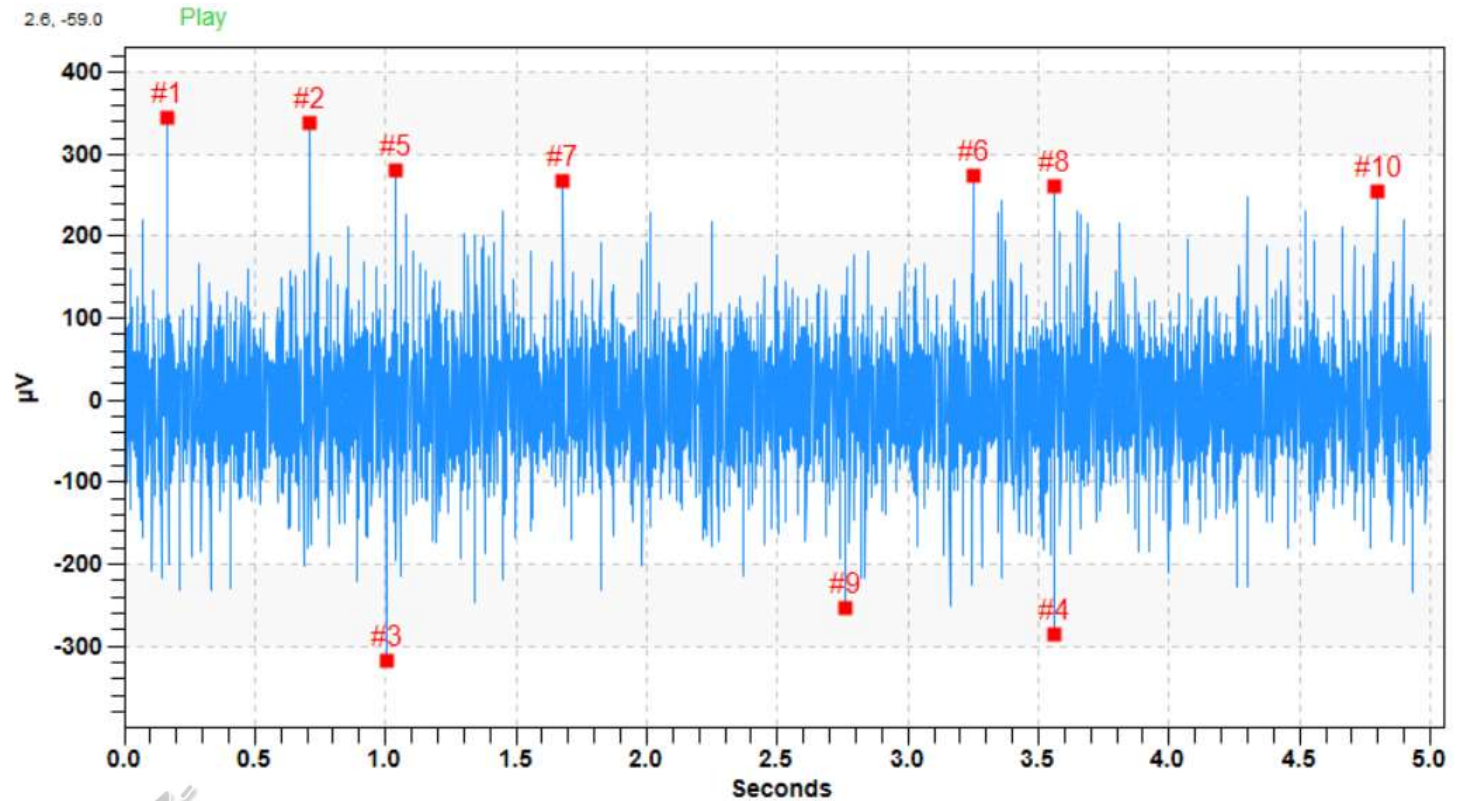
#1	1332 cpm	20.85 μV^2
#2	1524 cpm	12.92 μV^2
#3	3108 cpm	14.002 μV^2
#4	5316 cpm	14.863 μV^2
#5	6648 cpm	16.365 μV^2
#6	7980 cpm	15.609 μV^2
#7	13296 cpm	13.216 μV^2
#8	23868 cpm	13.473 μV^2
#9	25200 cpm	13.541 μV^2
#10	29268 cpm	12.447 μV^2

Small impacts show slight signs of metal to metal contact



Mechanical - Coupling Inspection

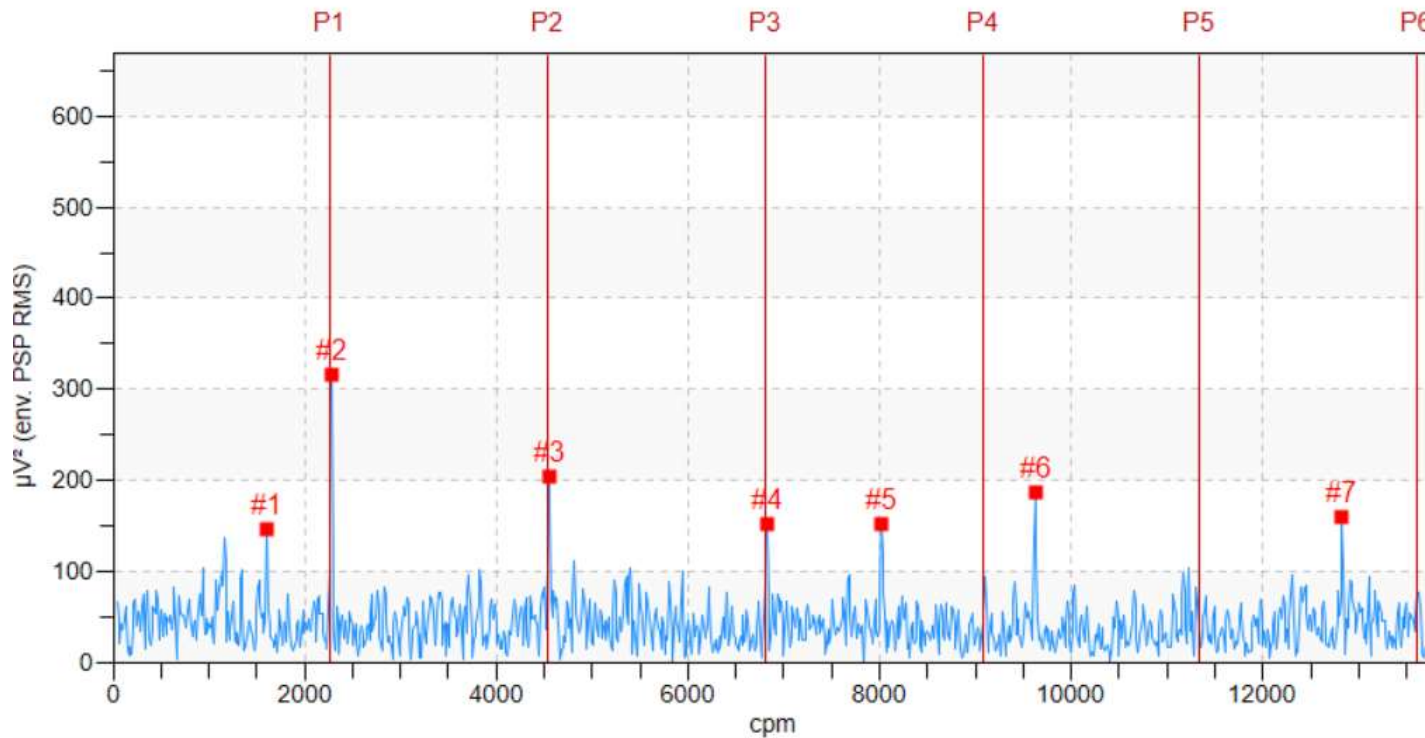
- **November 2018**
 - Higher Friction





Mechanical - Coupling Inspection

10446.215, 212.556



Highest Peaks		
<input type="radio"/>	Sorted by energy	
<input checked="" type="radio"/>	Sorted by frequency	
#1	1608 cpm	145.746 μV^2
#2	2280 cpm	315.258 μV^2
#3	4548 cpm	203.229 μV^2
#4	6828 cpm	151.267 μV^2
#5	8016 cpm	152.196 μV^2
#6	9624 cpm	186.914 μV^2
#7	12828 cpm	159.383 μV^2
#8	16044 cpm	137.3 μV^2
#9	17640 cpm	182.887 μV^2
#10	19248 cpm	152.421 μV^2

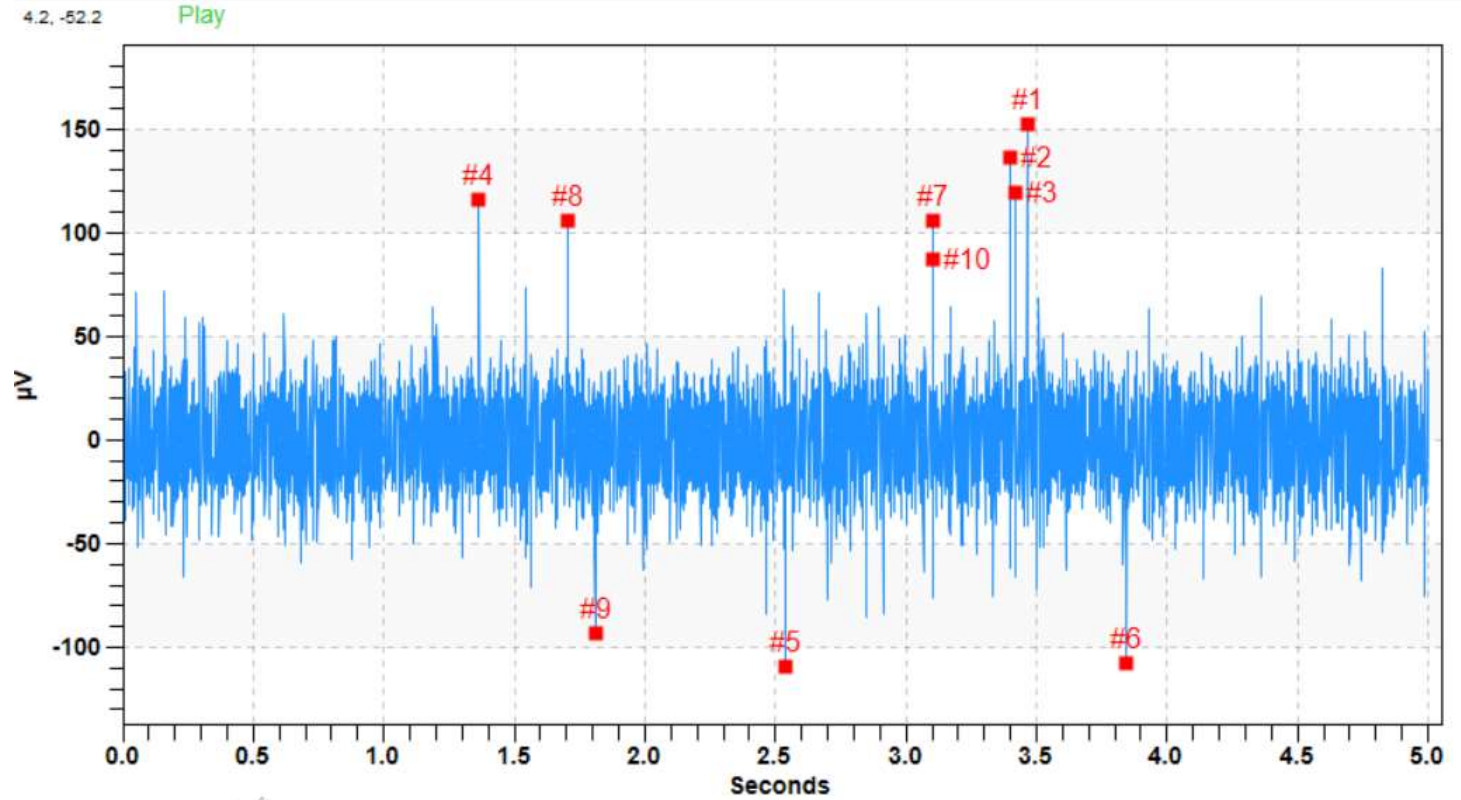
Increased impacting with harmonics show definite signs of metal to metal contact



Mechanical - Coupling Inspection

- December 2018

- Lubrication reduced friction

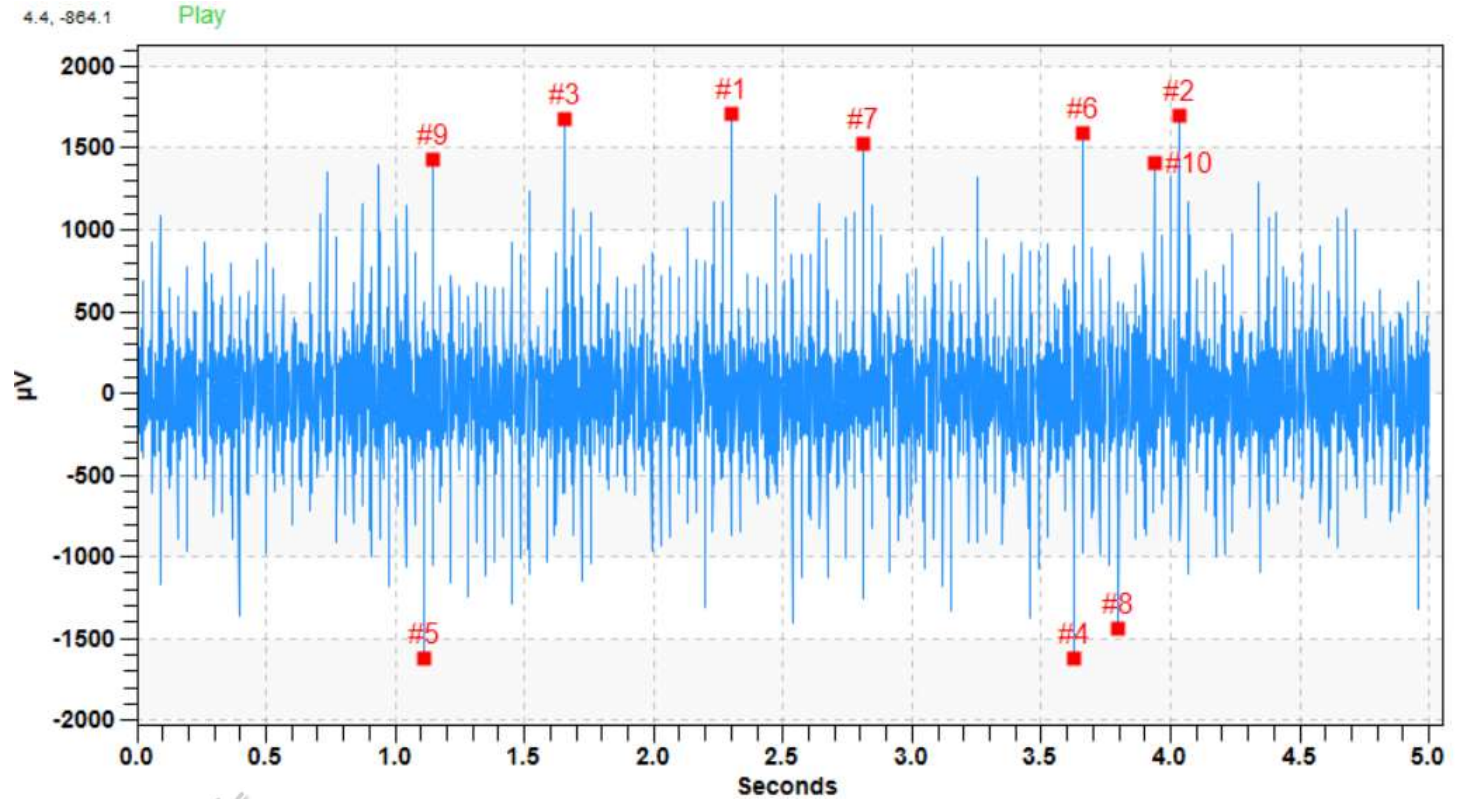




Mechanical - Coupling Inspection

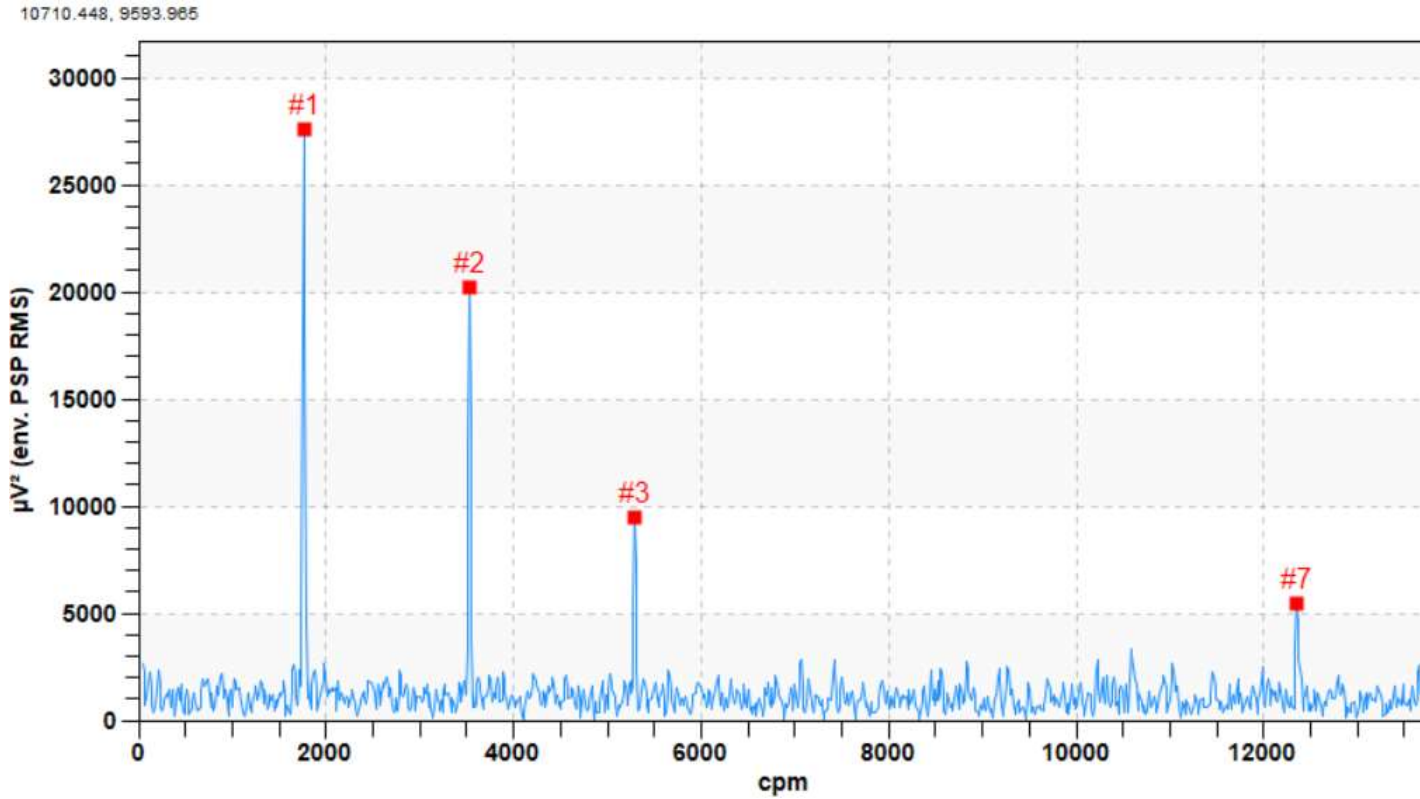
- Grid Coupling

- Poor lube
- Grid wear





Mechanical - Coupling Inspection



Highest Peaks

Sorted by energy

Sorted by frequency

#1	1764 cpm	27594.68 μV^2
#2	3528 cpm	20181.11 μV^2
#3	5292 cpm	9445.919 μV^2
#4	12348 cpm	5474.875 μV^2
#5	14112 cpm	6176.597 μV^2
#6	15876 cpm	5461.881 μV^2
#7	17640 cpm	5071.651 μV^2
#8	30000 cpm	5922.473 μV^2
#9	31764 cpm	6173.367 μV^2
#10	33528 cpm	5433.415 μV^2

Impacting seen at 1 x Running speed with harmonics

Mechanical - Coupling Inspection



Leaks



**Friction?
Impacting?
Turbulence?**



Grease Bearings Right



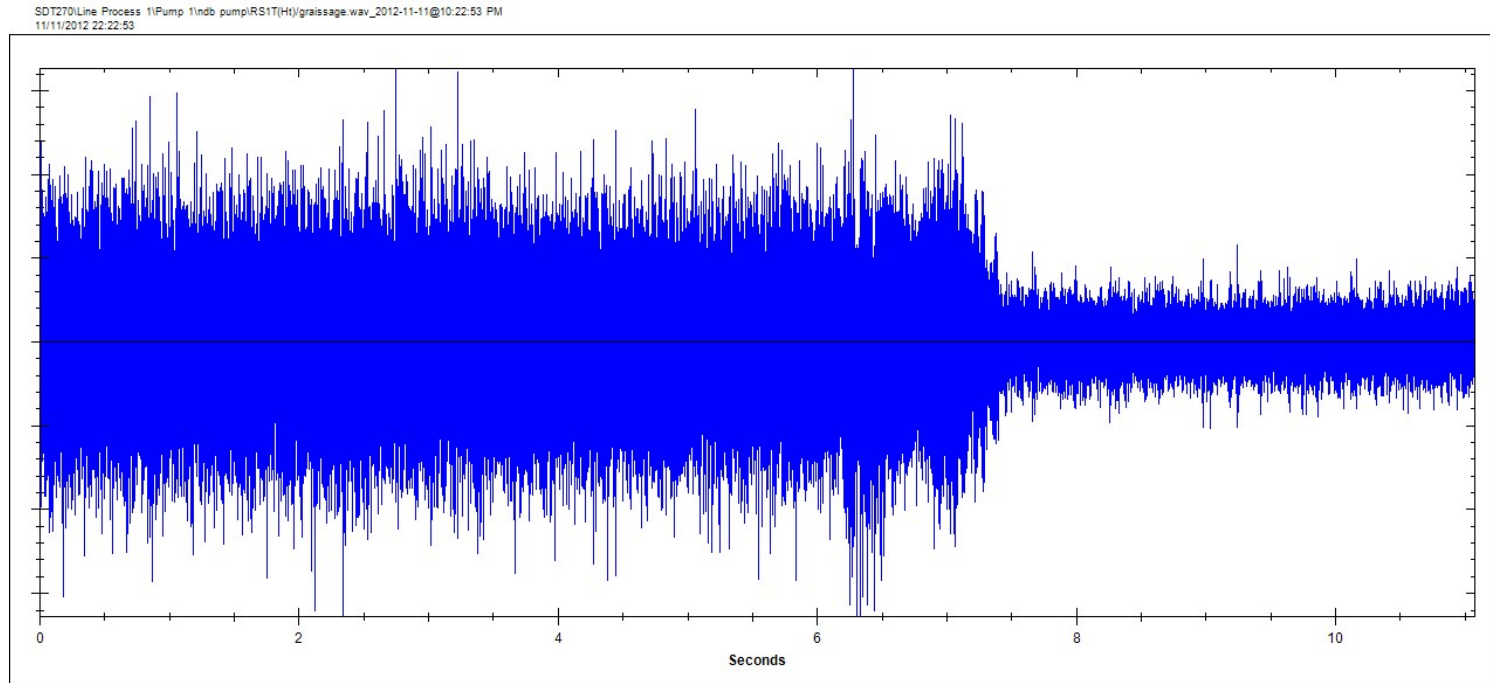
Ultrasound
Solutions

LUBExpert

Lubrication



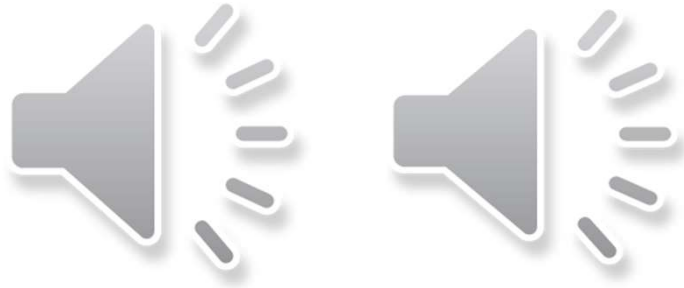
- Friction?
- Impacting?
- Turbulence?



Electrical



- Friction?
- Impacting?
- Turbulence?



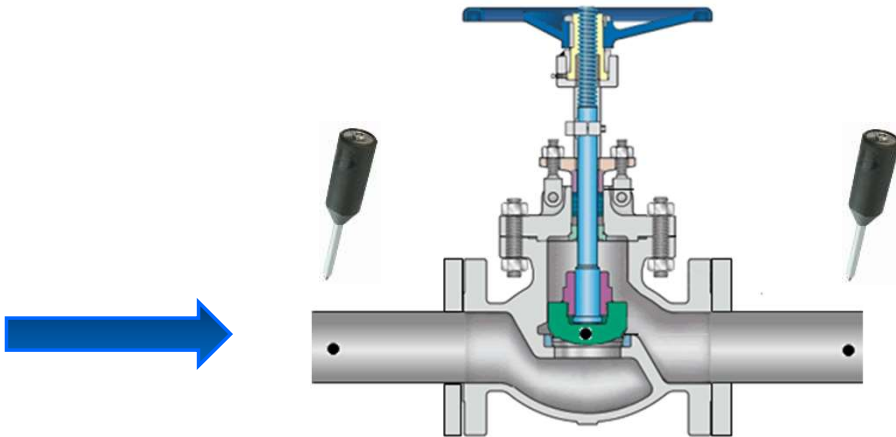
Electrical





Valves

- Friction?
- Impacting?
- Turbulence?



Simple failure modes

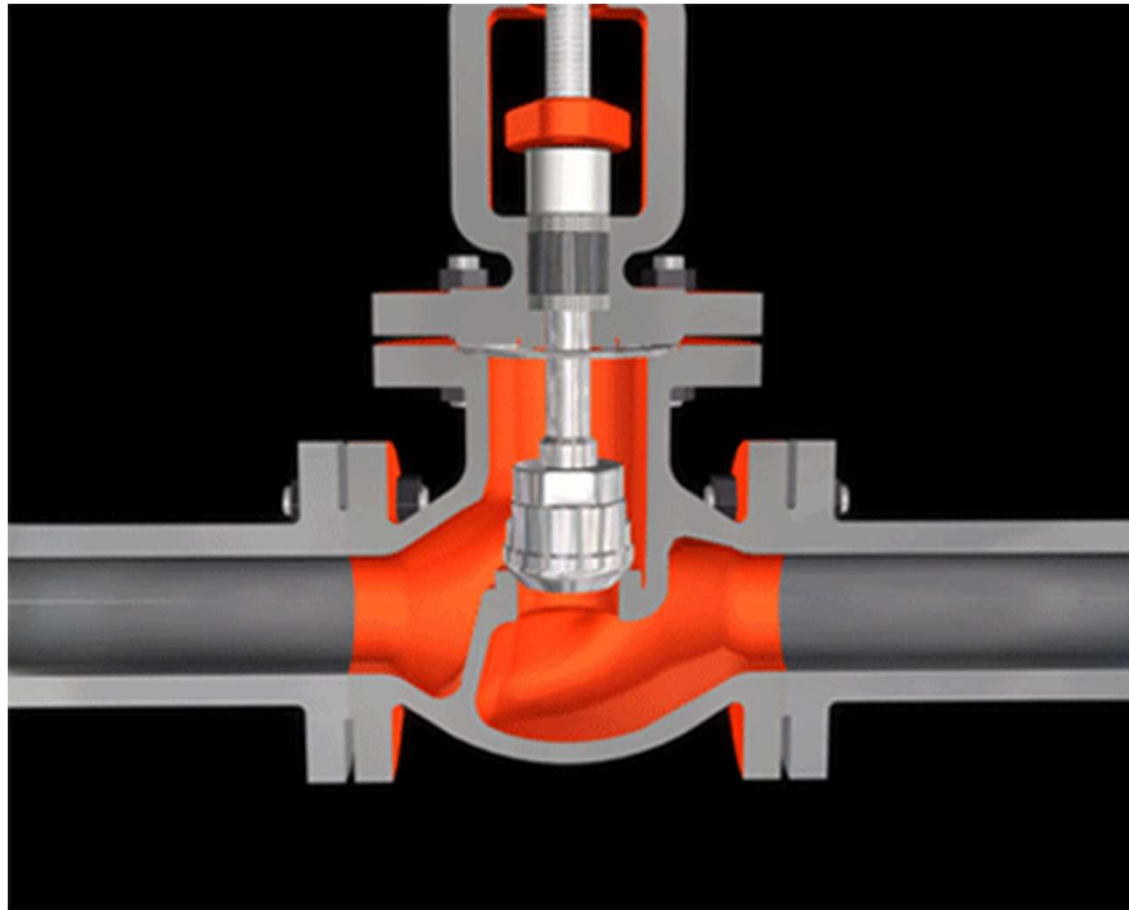
- **Blocked**
- **Passing**
- **Cavitating or Flashing**





Steam

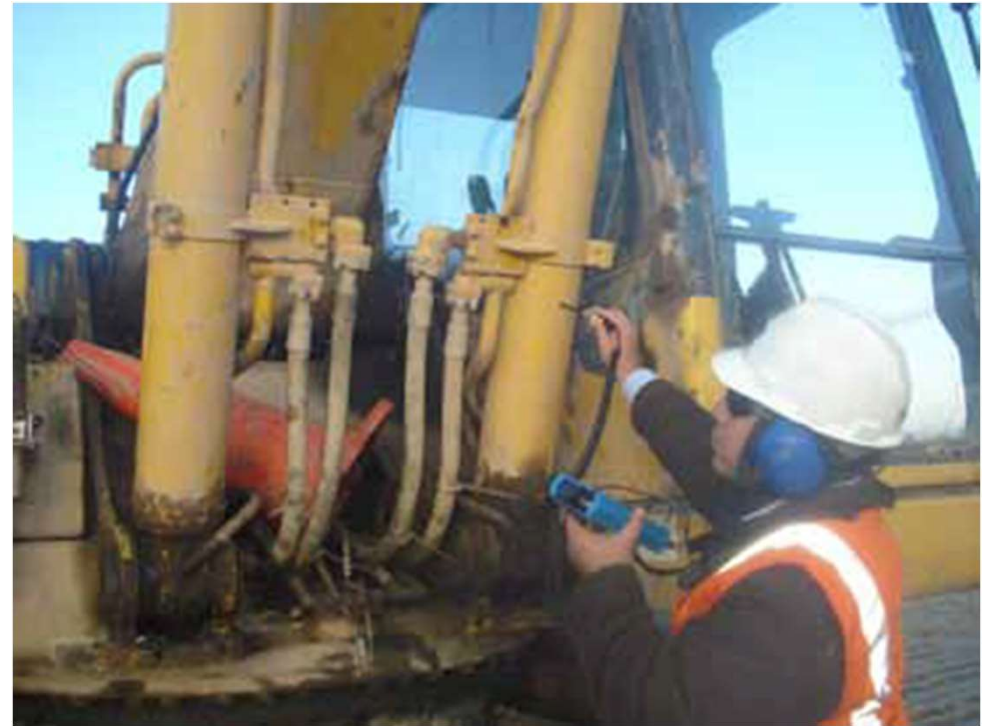
- Friction?
- Impacting?
- Turbulence?



Hydraulics



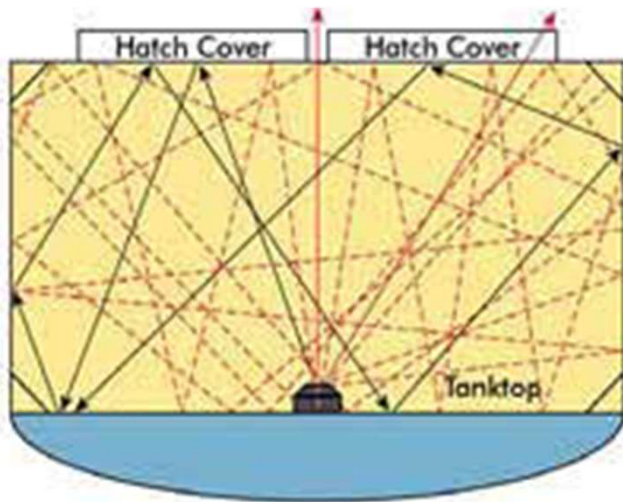
- Friction?
- Impacting?
- Turbulence?





Tightness

- Friction?
- Impacting?
- Turbulence?



Ultrasound Supports our Partnered Vision

ZERO

ACCIDENTS

DOWNTIME

WASTE



Review Exercise

Day 1 – Quiz 1