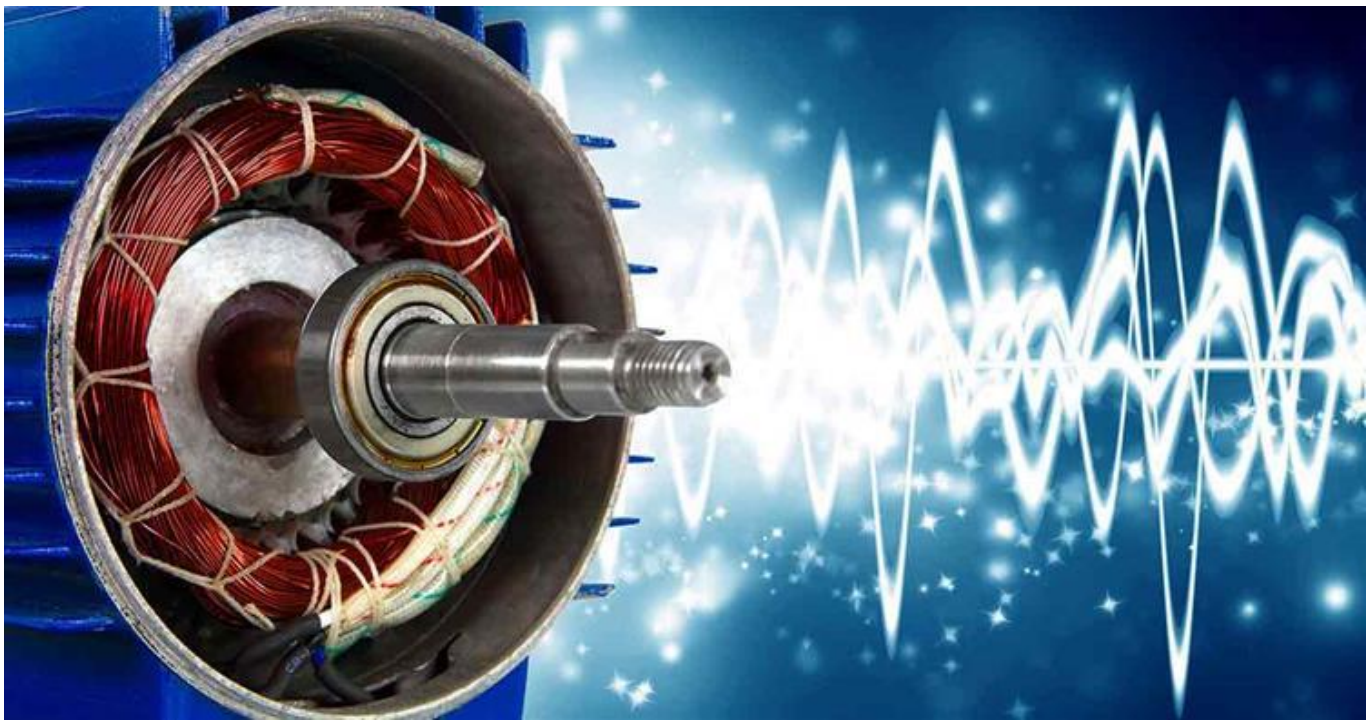
CHW Pump No.2 Vibration Analysis Case Study Report

Analysis Report by: Ryan Hanney

September 29, 2023



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CHW Pump No.2

ANALYSIS REPORT

Description			
Machine	CHW Pump No.2		
Location	Level 11 Plant room		
Designation			
Serial #			
Model	TP 150-660/4 A-F-A-BAQE-VW3		
Speed	Variable		
Criticality	High		
Previous Advice		Oper Cond	Rotation Speed Hz
6/21/2023 12:13 PM	Fair		14.4
7/5/2023 12:11 PM	Fair		14.2
8/23/2023 11:23 AM	Critical		14.5
Last Advice			
9/5/2023 11:31 AM	Excellent		14.2
Health is excellent (no defect, low vibration levels).			

Traceability			
Author	Ryan Hanney	Sensor	TREA 331
Instrument	FALCON 13678	Connector	Dual Rail Magnet
Approved by	Ryan Hanney	Date	11/09/2023

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Vibration Analysis:
Severe bearing wear on the motor DE bearing with additional wear present on the motor NDE bearing.

Both of the motor bearings are 6317-C3's
The motor DE bearing spectra displayed non-synchronous harmonics of BPFO (Outer Race Defect) at 45.26 hz, and each fundamental BPFO harmonics had sub-synchronous sidebands equating to the FTF bearing defect frequency at 5.65 hz.
The time waveform analysis displayed modulation and impacting with a delta frequency of 45.26 hz equating to BPFO (Outer Race Defect)

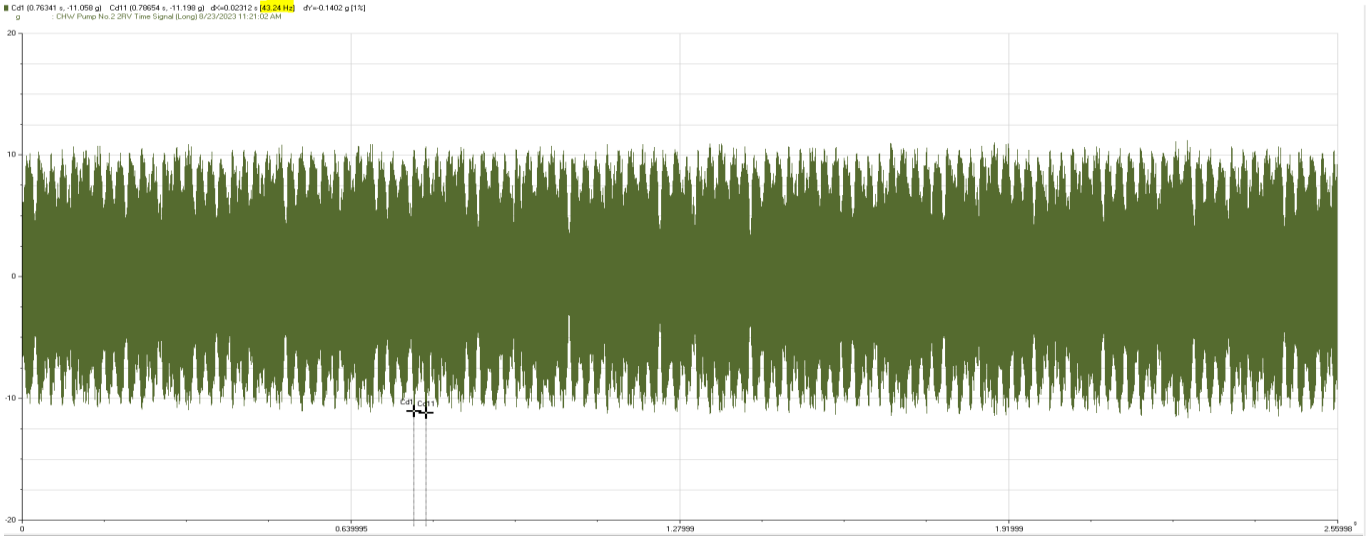
The highest pk-pk value is 22g's increasing from 13g's.
Additionally, suspect bearing fluting is occurring due to the number of sidebands and electrical noise surrounding the BPFO fundamental frequencies.

Following the motor bearing replacement conducted on the 26th of August, all of the vibration readings have decreased to healthy levels.

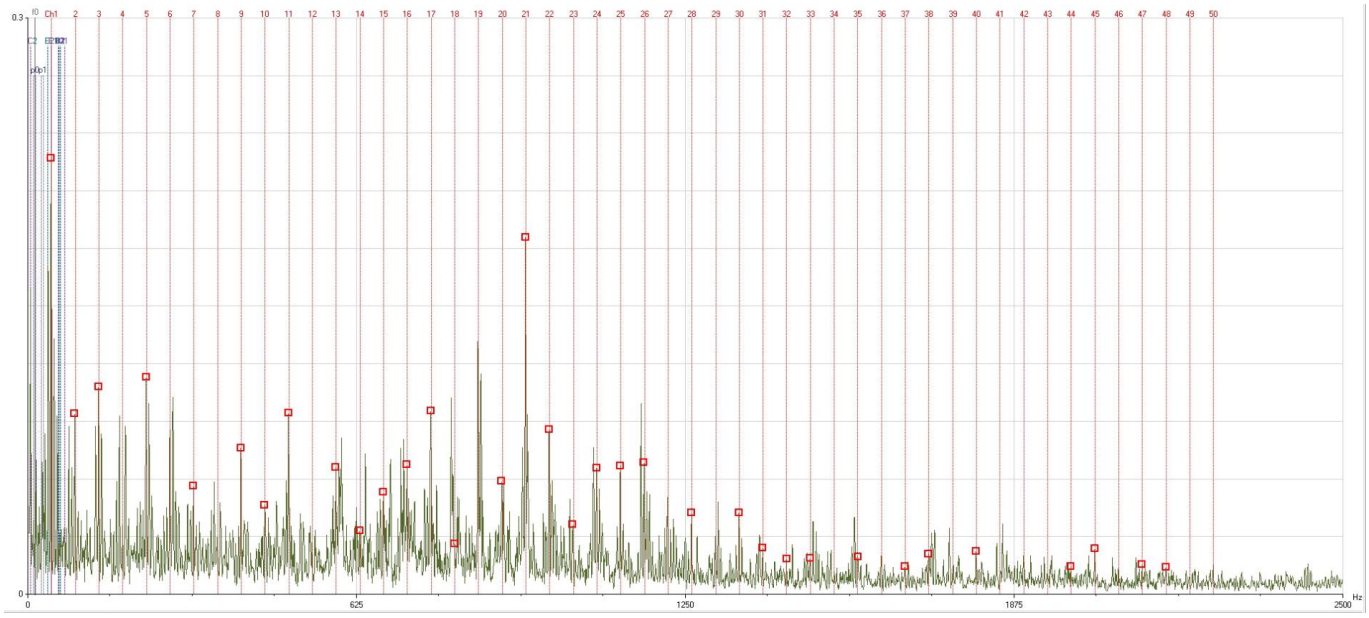
A new baseline has been created for this asset and its data set.

Bearing Analysis:
Bearing received in poor condition, the initial inspection found the lubricating grease was discoloured, however, the bearing did rotate freely.
Inspection of the housing interface of the outer race showed evidence of localised fretting corrosion. The inner race mounting interface was in good condition.
The motor bearing (location unknown) was found to have evidence of electrical fluting damage on both inner and outer raceways, probably caused by the variable frequency drive (VFD) supplying the motor.
The lubricant analysis compliments the inspection with elevation in the raceway elements (iron, chromium).

Recommendation:
Our recommendation would be to ensure a correctly specified VFD-rated motor is installed, examine the motor earth and ensure it is sufficient and correctly earthed or install ceramic/insulated bearings.



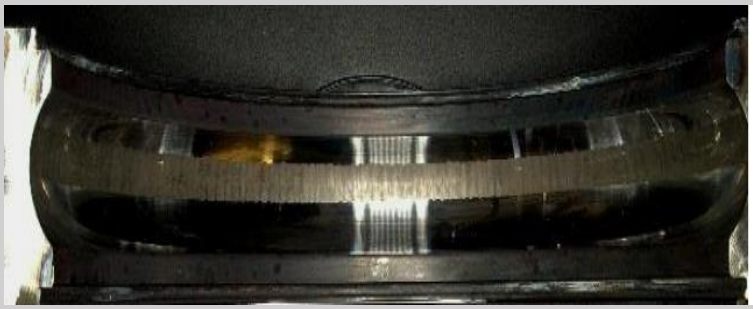
The raw vibration time waveform above displays a high noise level with non-synchronous impacts. The delta frequency of the impacts equates to 43.24 hz with an amplitude of 22g's pk-pk.



The envelope spectrum above displays the non-synchronous harmonic of BPFO (Outer Race Defect) at 45.26 hz with sub-synchronous sidebands equating to the FTF-bearing (Cage defect frequency) at 5.65 hz.

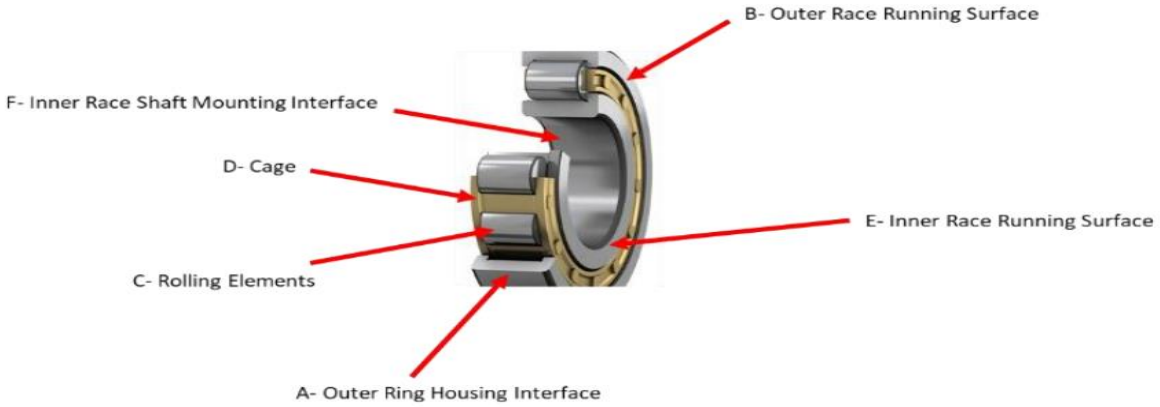
Bearing Wear debris and lubricant analysis by British Engineering Services Asset Reliability – ORS 6317-C3

- **Inspection Detail and Supporting Information**

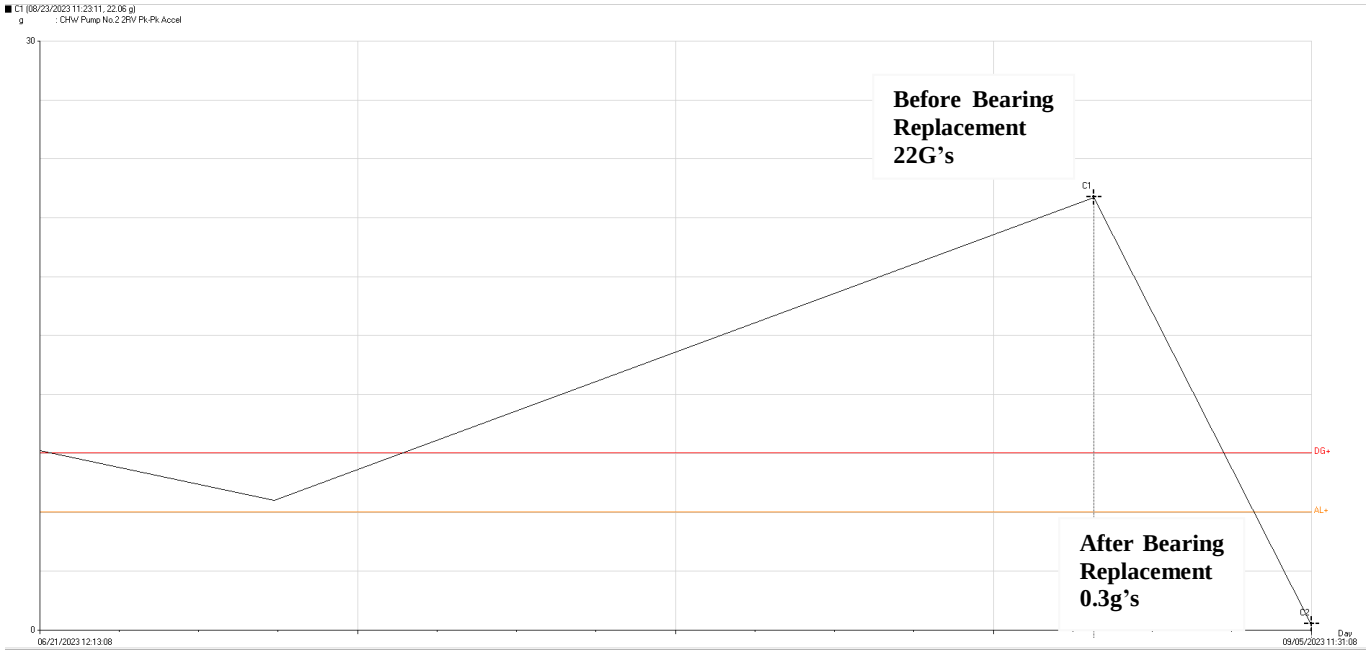
Bearing Inspection – Outer Ring Housing Interface	
Image	**Inspection Narrative**
	Evidence of localised fretting corrosion visible with a reddish-brown oxide colour
Bearing Inspection – Outer Raceway Running Surface	
	Evidence of electrical fluting damage on outer raceways
	Close up of electrical fluting damage on outer raceways

- **Supplied Parts and Overview**

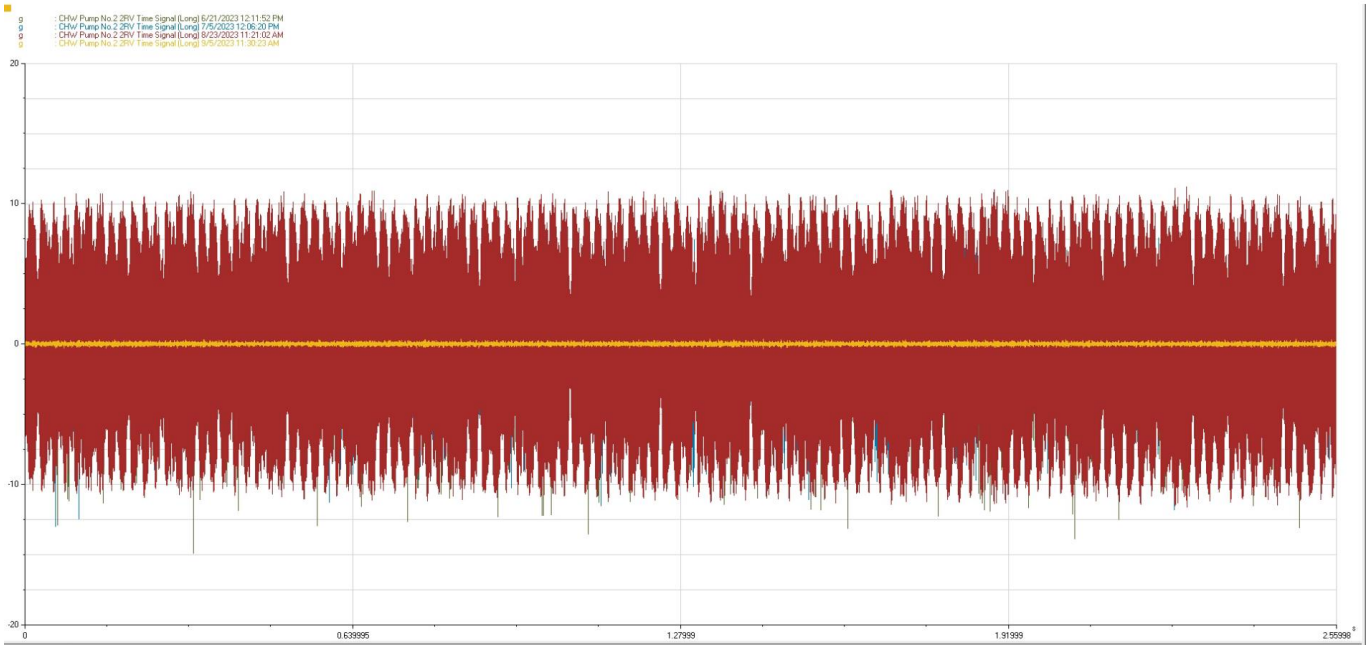
Bearing Overview	
Asset Reference	CHW Pump No.2
Measurement Location Reference	Motor DE
Last Recorded Vibration data prior to removal	Elevated levels of Outer race bearing defect with sidebands (Suspect Fluting)
Bearing Type & Manufacturer	ORS 6317
Lubricant Type incl. Manufacturer and NGLI Grade	Grease type unknown
Bearing in a failed condition?	Asset was still operational when removed
Overview of Inspected Condition	



A- Outer Ring Housing Interface	Localised fretting corrosion
B- Outer Race Running Surface	Evidence of electrical fluting
C- Rolling Elements	All rolling elements are discoloured
D- Cage	Good Condition
E- Inner Race Running Surface	Evidence of electrical fluting
F- Inner Race Shaft Mounting Interface	Good Condition



The vibration trend above (overall PK-PK G's) displays a clear decrease in vibration 'G' levels (22g's – 0.3g's) following the motor bearing replacement on the 26th of August 2023.



The merged time waveform above contains the previous four data sets from the Motor DE displaying a decrease in vibration values and friction levels following the motor bearing replacement on the 26th of August 2023.

Estimated Impact Avoidance savings:

Action Taken	No Action Taken
Actual work completed: Replacement of the motor bearings and seals.	**Scenario: S**econdary damage to the motor and pump assembly due to the failure of the motor bearings.
MATERIALS: 6317-C3 bearings x2 O-ring EPDM 430.66x3,53/spare x1 Shaft seal eMG BAQE GG D48 x1 **£2232.00**	**35% of ERV (Estimated Replacement Value)** **Grundfos statement – 'This Item is no longer in production** The recommended replacement unit costs £25,390.00. (Motor pump set 7-10-day lead time) **£ 8,886.50**
LABOUR: To lift and remove the motor from the pump and replace the bearings. & Re install Refit 1-day 3 people **£6,160.00**	**LABOUR:** To lift and remove the motor and pump set, check for further damage to pipework, and install the new motor and pump set Refit 2-day 3 people **£12,320.00**
Production Losses: None, Standby Unit available.	**Production Losses:** None, Standby Unit available.
Total Cost: £8392.00	**Total Cost: £21,206.50**

ESTIMATED AVOIDED COSTS: £ 12,814.50