HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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The following is a summary of findings from the December 2023 WEEK 1 vibration survey at the H2O2 Plant that was performed on December 8, 2023.

QualiTest® uses a four step rating system for defects.

CLASS I: Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

CLASS II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

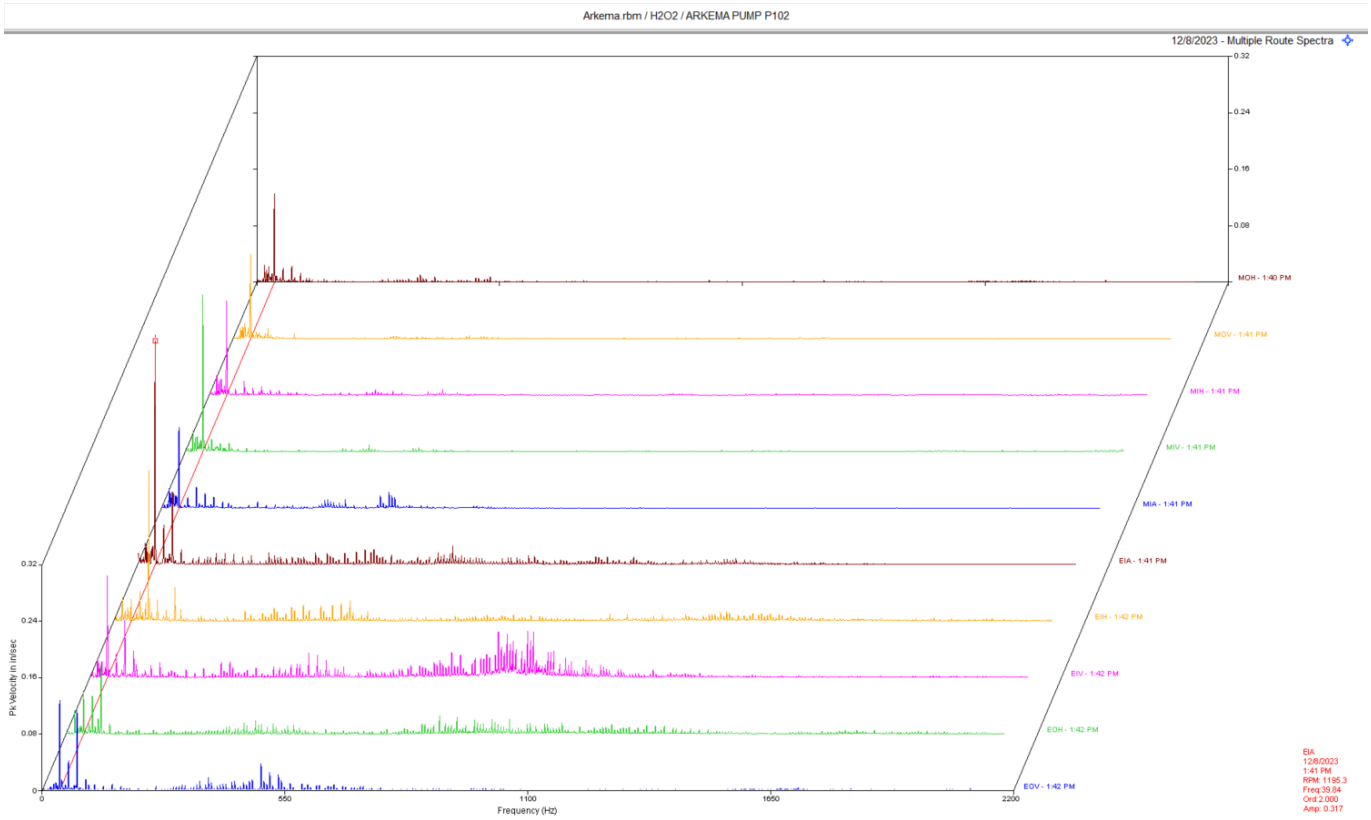
CLASS III: Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

CLASS IV: Defect (s) present that makes continued reliability unpredictable, and possibility of secondary damage is high. Repairs should be made ASAP. An unscheduled shutdown should be considered for repairs

Defect Summary

WEEK 2 H2O2 Plant

Pump 102 P102 CLASS I



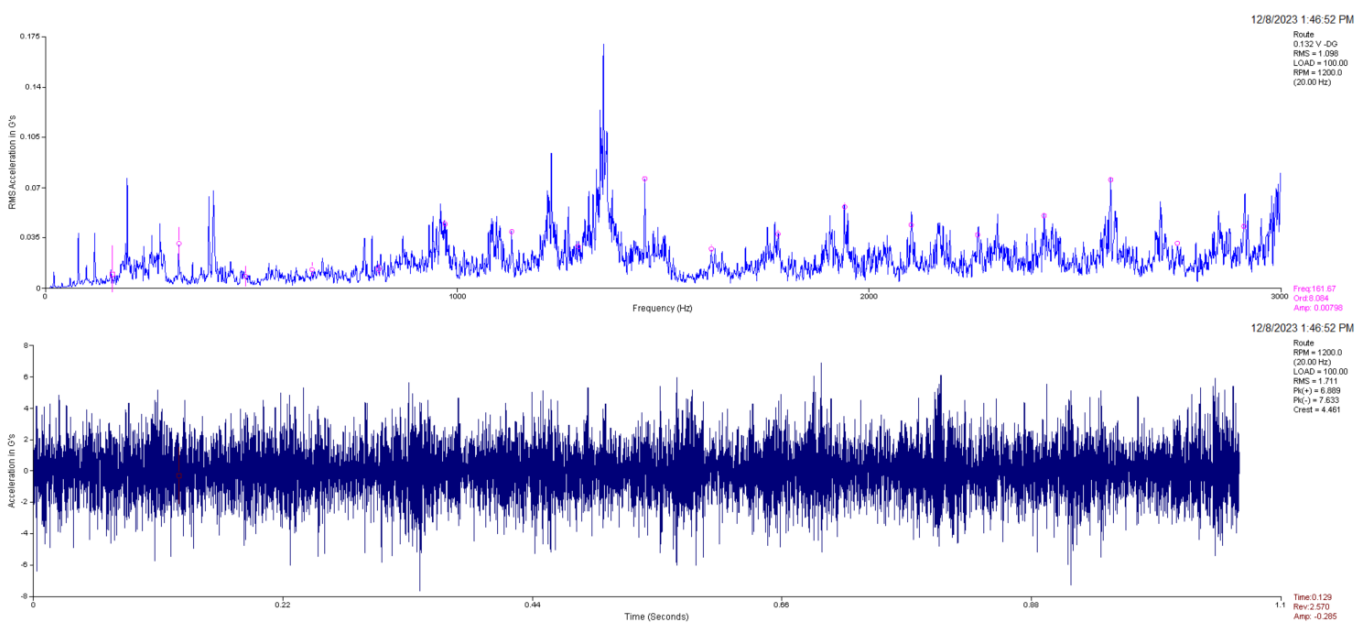
Observation:

Data above is a multipoint spectral waterfall. Pump data (EIA-EOV) shows axial vibration with multiple rpm harmonics throughout the pump spectra.

Recommendation:

The pump appears to have possible internal wear beginning to occur. The higher vibration in the axial direction may indicate excessive axial clearances. We are monitoring this very closely.

C Concentrator Vacuum Pump CLASS I



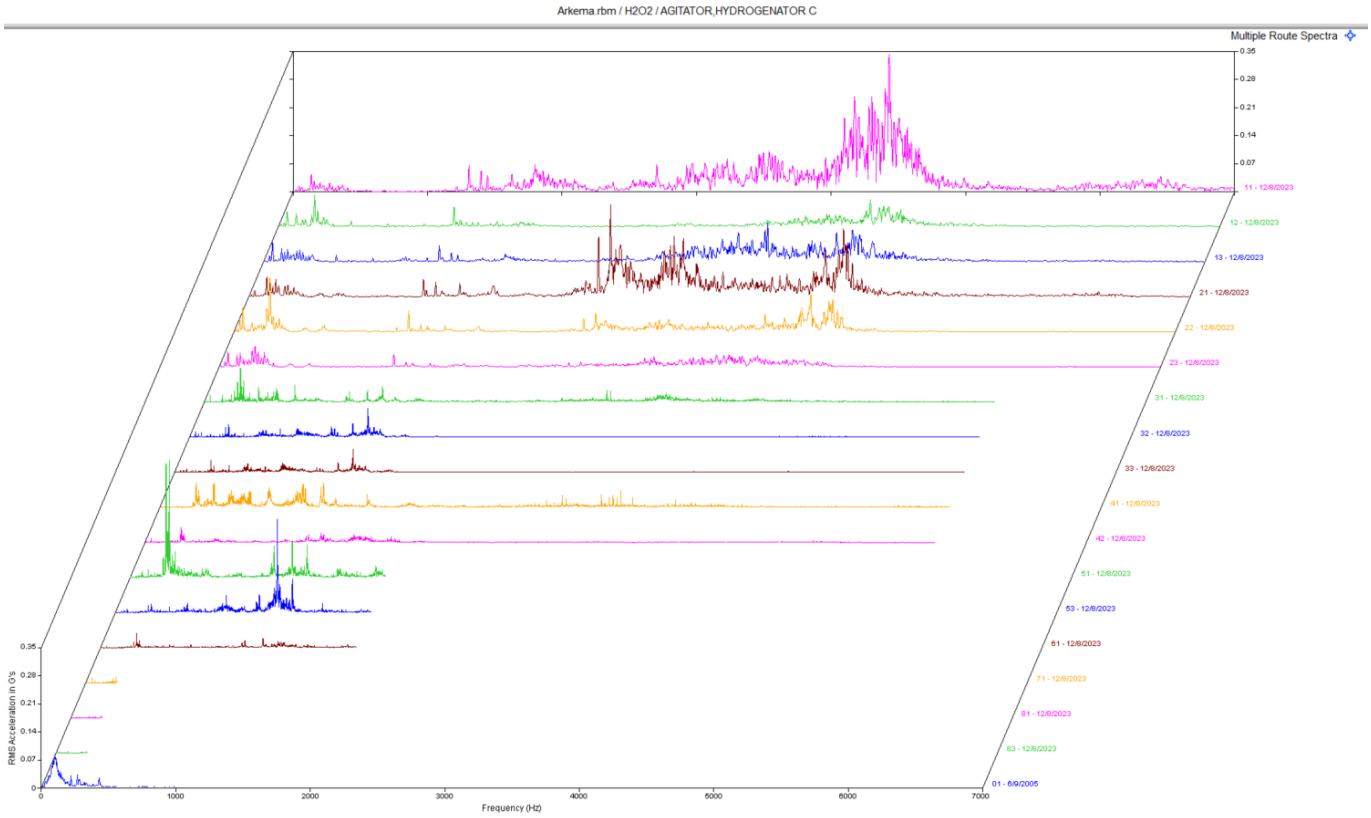
Observation:

Data above is the pump drive end horizontal. The small peaks in mid to high range of the spectrum are non-synchronous peaks and are very likely bearing defect frequencies but may be impeller related if pump has 8 vanes.

Recommendation:

The pump appears to have early to mid-stage bearing defects/wear and or impeller issues. We need to confirm the number of vanes on impeller. We are monitoring this issue closely.

Agitator, Hydrogenator C **CLASS I**



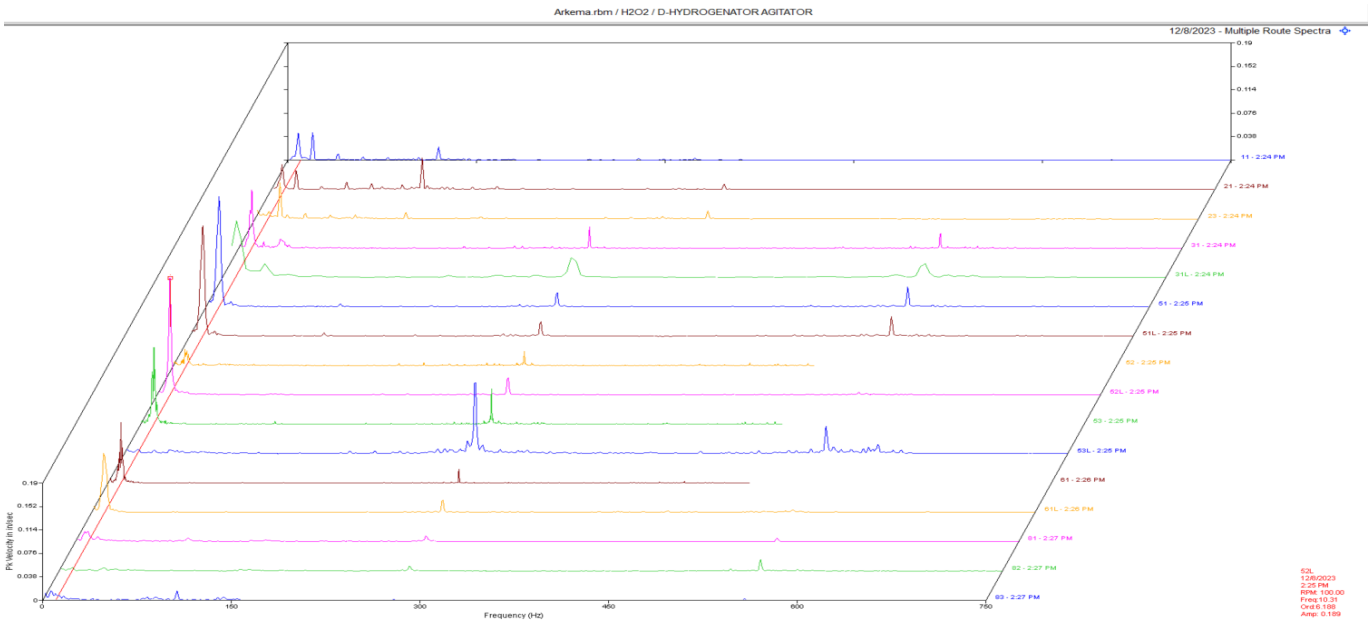
Observation:

Data above is a multipoint spectral waterfall. Data still shows some noise floor in the motor data. Data points labeled 11-23.

Recommendation:

Motor data still suggests a possible issue in the motor. May be rolling element defects in bearings. This issue appears to be minor at this time and we are monitoring this closely.

D Hydrogenator Agitator CLASS II



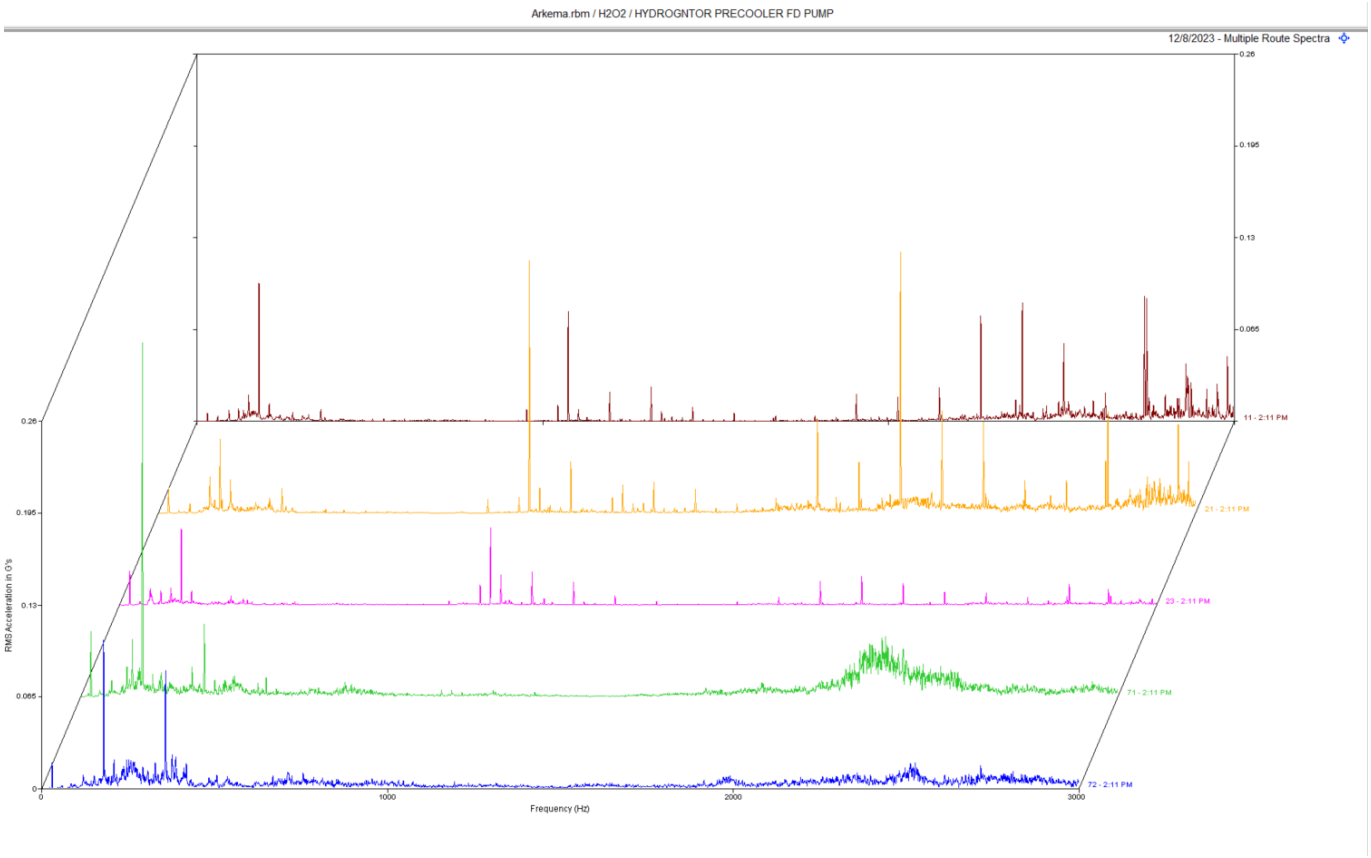
Observation:

Data above is a multi-point spectrum of the motor and gear drive and overall velocity amplitude trends for two of the higher vibration points. Data shows some low frequency vibration in the gear drive. Spectral and waveform data shows a dominant low frequency vibration that is likely a harmonic of output speed of the gearbox. Gearbox does appear to have visible torsional movement. There is also some gear mesh harmonics on the output axial that have increased in amplitude.

Recommendation:

Ensure output shaft does not excessive shaft defection. Check coupling hubs and shaft for run out using a dial indicator. Will continue to monitor closely.

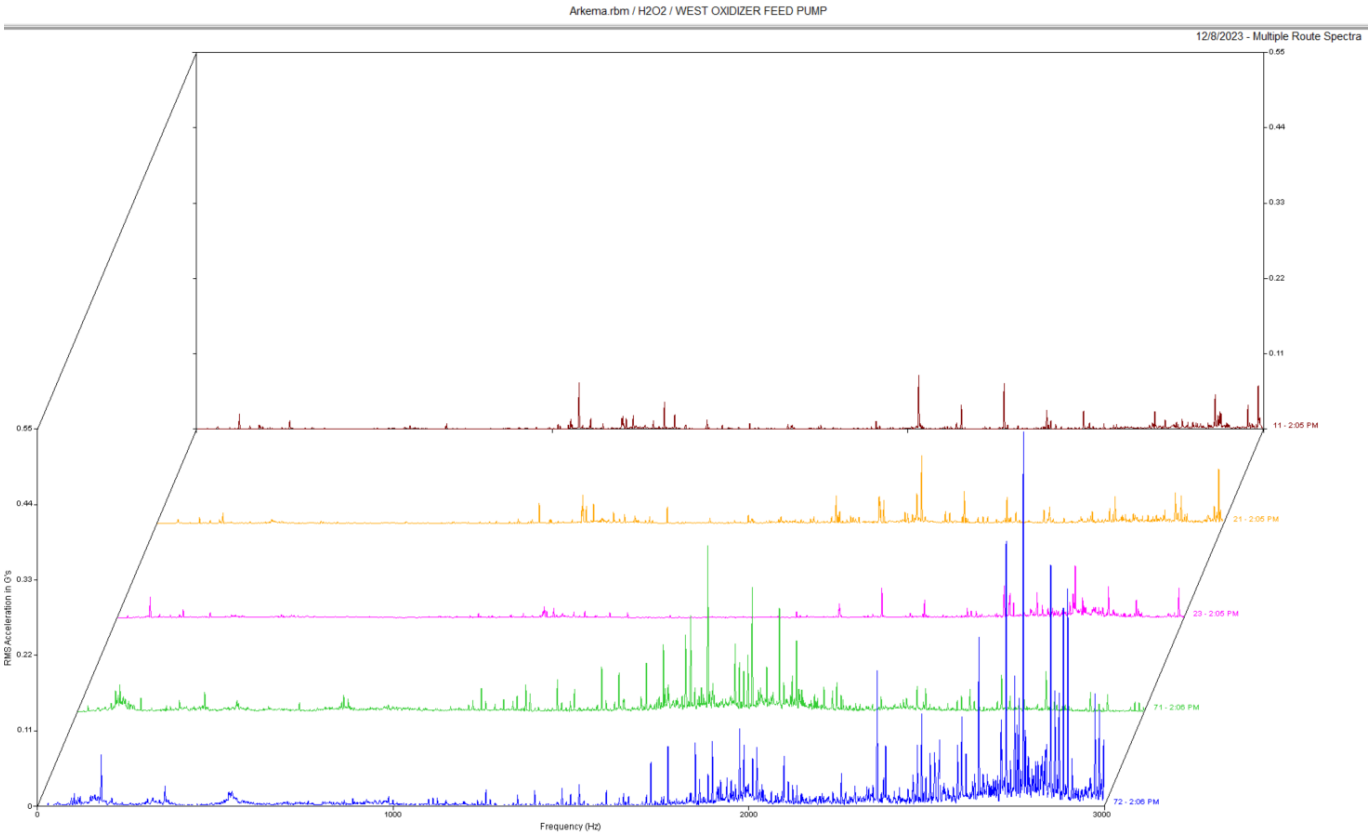
236-04A Hydrogenator Precooler Feed Pump CLASS I



Observation:
Motor data shows both electrical and mechanical defects according to the multi point spectra above.

Recommendation:
Data suggests some electrical and or mechanical issues may be present. Amplitudes are low at this time.

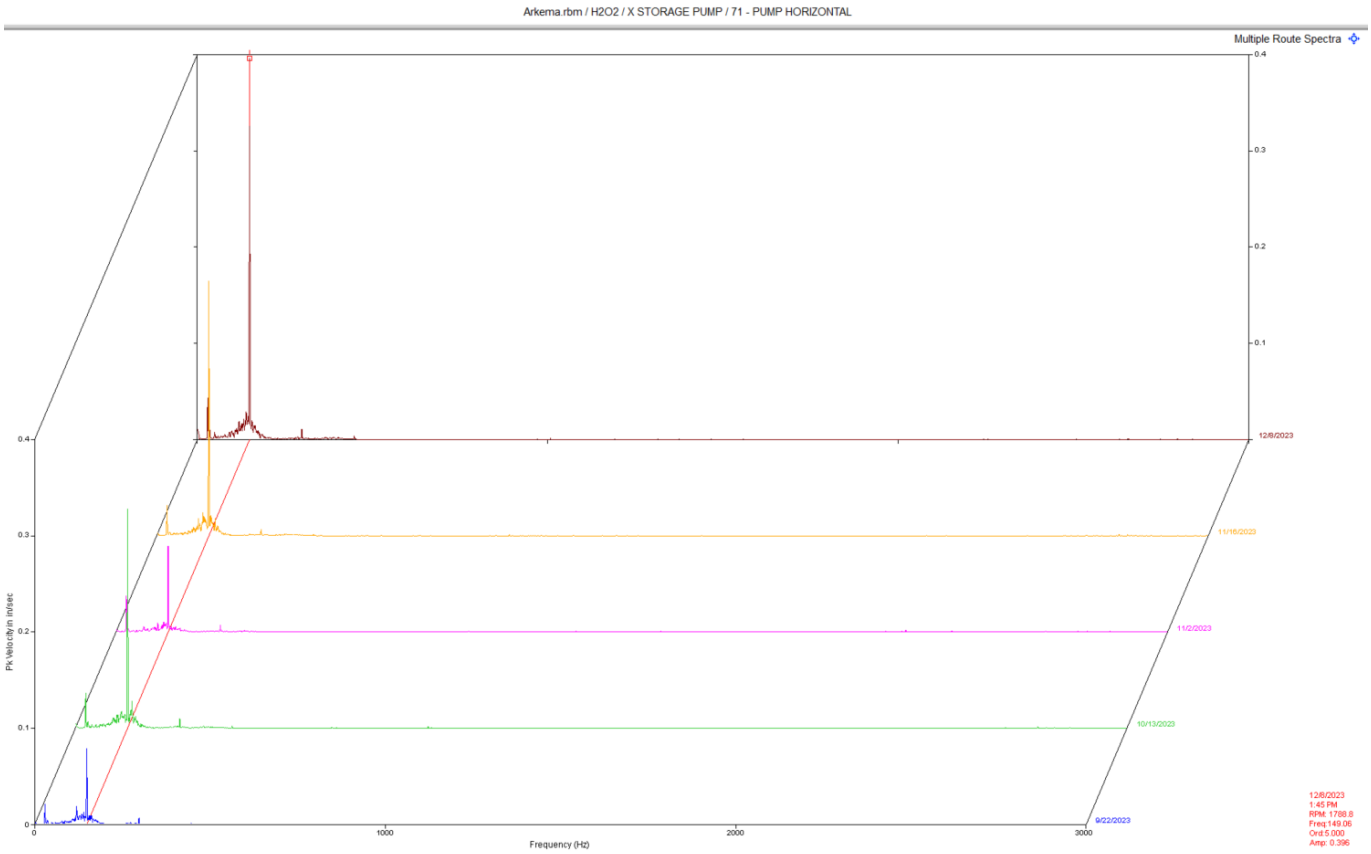
West Oxidizer Feed Pump



Observation:
Pump data shows signs of bearing defects according to the multi point spectra above.

Recommendation:
Data suggests bearing defects of the pump. Inspect/replace pump as time allows.

X Storage Pump CLASS II



Observation:
Pump data shows an increase in 5 x rpm vibration from 9/2/23 to 12/8/23. This frequency is likely the vane pass frequency of the pump.

Recommendation:
Inspect pump flow parameters and ensure pump is operating properly.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 1: ARK WK 1

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
P102	- ARKEMA PUMP P102	(08-Dec-23)	
		OVERALL LEVEL	1K-20KHz
MOH		.152 In/Sec	.726 G-s
MOV		.139 In/Sec	.487 G-s
MIH		.157 In/Sec	.652 G-s
MIV		.246 In/Sec	.792 G-s
MIA		.155 In/Sec	.277 G-s
EIA		.392 In/Sec	1.246 G-s
EIH		.293 In/Sec	1.588 G-s
EIV		.358 In/Sec	1.863 G-s
EOH		.206 In/Sec	1.943 G-s
EOV		.221 In/Sec	.719 G-s
XSTORPMP	- X STORAGE PUMP	(08-Dec-23)	
		OVERALL LEVEL	1-20 KHz
11		.062 In/Sec	.463 G-s
21		.071 In/Sec	.478 G-s
23		.056 In/Sec	.240 G-s
71		.423 In/Sec	.178 G-s
72		.085 In/Sec	.057 G-s
2130-1old	- C Concentrator Vacuum Pump	(08-Dec-23)	
		OVERALL LEVEL	1-20 KHz
11		.065 In/Sec	.519 G-s
21		.068 In/Sec	.615 G-s
23		.112 In/Sec	.145 G-s
71		.132 In/Sec	2.975 G-s
81		.173 In/Sec	.530 G-s
83		.151 In/Sec	1.006 G-s
7000-01	- AGITATOR,HYDROGENATOR C	(08-Dec-23)	
		OVERALL LEVEL	1-20 KHZ
02		.050 In/Sec	.030 G-s
03		.044 In/Sec	.0085 G-s
11		.070 In/Sec	2.375 G-s
12		.084 In/Sec	.487 G-s
13		.094 In/Sec	.643 G-s
21		.075 In/Sec	1.328 G-s
22		.135 In/Sec	.610 G-s
23		.084 In/Sec	.282 G-s
31		.074 In/Sec	.324 G-s
32		.064 In/Sec	.229 G-s
33		.048 In/Sec	.174 G-s
41		.083 In/Sec	.513 G-s
42		.064 In/Sec	.308 G-s
51		.188 In/Sec	.620 G-s
53		.050 In/Sec	.740 G-s
61		.033 In/Sec	.241 G-s
71		.041 In/Sec	.456 G-s
81		.022 In/Sec	.194 G-s
83		.026 In/Sec	.156 G-s

57 - A/B Concentr Vac Pmp-var RPM (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.044 In/Sec	.449 G-s
12	.052 In/Sec	.213 G-s
21	.079 In/Sec	.470 G-s
23	.059 In/Sec	.252 G-s
71	.151 In/Sec	.491 G-s
81	.318 In/Sec	1.689 G-s
83	.104 In/Sec	.766 G-s

2130-1 - FLASH VAP VAC PUMP-var speed (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.046 In/Sec	.312 G-s
12	.036 In/Sec	.089 G-s
21	.050 In/Sec	1.079 G-s
22	.047 In/Sec	.250 G-s
23	.052 In/Sec	.183 G-s
71	.079 In/Sec	.659 G-s
72	.084 In/Sec	.466 G-s
81	.088 In/Sec	1.347 G-s
82	.082 In/Sec	.536 G-s
83	.052 In/Sec	.492 G-s

236-06 - HYDRO FD PUMP N 236-06 -2FLR (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.143 In/Sec	.267 G-s
21	.077 In/Sec	.935 G-s

2130-6 - ABC SEC FILT FEED PUMP-NORTH (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.047 In/Sec	1.276 G-s
21	.036 In/Sec	1.963 G-s
23	.044 In/Sec	1.137 G-s
71	.197 In/Sec	1.310 G-s
72	.119 In/Sec	.962 G-s

9001-1 - EAST OXIDIZER FEED PUMP (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.036 In/Sec	.515 G-s
21	.044 In/Sec	.638 G-s
23	.055 In/Sec	1.241 G-s
71	.112 In/Sec	.613 G-s
72	.093 In/Sec	.706 G-s

9001-2 - MIDDLE OXIDIZER FEED PUMP (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.040 In/Sec	.964 G-s
21	.049 In/Sec	.794 G-s
23	.055 In/Sec	.827 G-s
71	.067 In/Sec	.277 G-s
72	.086 In/Sec	.742 G-s

7016-11 - WEST OXIDIZER FEED PUMP (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.024 In/Sec	.586 G-s
21	.020 In/Sec	.868 G-s
23	.034 In/Sec	.539 G-s
71	.090 In/Sec	.860 G-s
72	.083 In/Sec	2.236 G-s

234-01 - CHILL WATER PUMP 234-01 (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	.771 G-s
21	.039 In/Sec	.518 G-s
23	.057 In/Sec	
71	.132 In/Sec	.864 G-s
72	.056 In/Sec	.969 G-s

C-203 - C-203 Comp (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.083 In/Sec	3.959 G-s
12	.032 In/Sec	.870 G-s
21	.053 In/Sec	2.152 G-s
22	.030 In/Sec	.500 G-s
23	.024 In/Sec	.132 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.087 In/Sec	4.926 G-s
72M	.052 In/Sec	.854 G-s
73M	.079 In/Sec	1.543 G-s
81M	.046 In/Sec	12.99 G-s
82M	.034 In/Sec	2.247 G-s
71F	.050 In/Sec	3.593 G-s
72F	.057 In/Sec	2.558 G-s
73F	.040 In/Sec	1.902 G-s
81F	.043 In/Sec	12.55 G-s
82F	.047 In/Sec	2.903 G-s

9000-02 - D HYDROGENATOR FD PUMP- EAST (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.047 In/Sec	.615 G-s
21	.044 In/Sec	.780 G-s
23	.054 In/Sec	1.040 G-s
71	.120 In/Sec	.760 G-s
72	.079 In/Sec	.889 G-s

236-04A - HYDROGNTOR PRECOOLER FD PUMP (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.060 In/Sec	.803 G-s
21	.072 In/Sec	.945 G-s
23	.087 In/Sec	1.621 G-s
71	.196 In/Sec	.922 G-s
72	.093 In/Sec	.824 G-s

C-202 - C-202 Comp (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.179 In/Sec	7.511 G-s
12	.159 In/Sec	1.422 G-s
21	.072 In/Sec	1.496 G-s
22	.059 In/Sec	.404 G-s
23	.051 In/Sec	.343 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.054 In/Sec	4.857 G-s
72M	.044 In/Sec	1.002 G-s
73M	.081 In/Sec	1.365 G-s
81M	.052 In/Sec	4.571 G-s
82M	.045 In/Sec	1.115 G-s
71F	.034 In/Sec	2.671 G-s
72F	.074 In/Sec	1.186 G-s
73F	.036 In/Sec	.647 G-s
81F	.040 In/Sec	8.240 G-s
82F	.059 In/Sec	2.086 G-s

C-201 - C-201 Comp (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.119 In/Sec	3.498 G-s
12	.042 In/Sec	.730 G-s
21	.107 In/Sec	1.459 G-s
22	.035 In/Sec	.437 G-s
23	.067 In/Sec	.210 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.076 In/Sec	4.081 G-s
72M	.042 In/Sec	1.440 G-s
73M	.078 In/Sec	1.370 G-s
81M	.057 In/Sec	9.242 G-s
82M	.037 In/Sec	1.097 G-s
71F	.038 In/Sec	4.824 G-s
72F	.074 In/Sec	1.872 G-s
73F	.040 In/Sec	1.331 G-s

81F	.039 In/Sec	4.275 G-s
82F	.065 In/Sec	1.774 G-s

new AC - INSTRUMENT AIR COMPRESSOR (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.095 In/Sec	1.121 G-s
12	.094 In/Sec	.626 G-s
13	.043 In/Sec	.197 G-s
21	.073 In/Sec	1.444 G-s
22	.063 In/Sec	.567 G-s
23	.049 In/Sec	.323 G-s
	OVERALL LEVEL	1-20 KHZ
71F	.113 In/Sec	9.617 G-s
72F	.113 In/Sec	3.716 G-s
73F	.139 In/Sec	1.475 G-s
81F	.096 In/Sec	4.397 G-s
82F	.145 In/Sec	1.841 G-s
83F	.145 In/Sec	2.272 G-s
71M	.139 In/Sec	7.906 G-s
72M	.120 In/Sec	1.782 G-s
73M	.115 In/Sec	1.386 G-s
81M	.188 In/Sec	7.297 G-s
82M	.312 In/Sec	2.699 G-s
83M	.207 In/Sec	1.702 G-s

201-08A - COMPRESSOR,NASH A 201-08A (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.057 In/Sec	.127 G-s
12	.084 In/Sec	.088 G-s
13	.110 In/Sec	.105 G-s
21	.057 In/Sec	.306 G-s
22	.030 In/Sec	.114 G-s
23	.054 In/Sec	.172 G-s
71	.171 In/Sec	.539 G-s
72	.140 In/Sec	.063 G-s
73	.188 In/Sec	.139 G-s
81	.114 In/Sec	.246 G-s
82	.190 In/Sec	.045 G-s
83	.202 In/Sec	.044 G-s

9002-10 - D-HYDROGENATOR AGITATOR (08-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.076 In/Sec	.295 G-s
21	.084 In/Sec	.384 G-s
23	.072 In/Sec	.102 G-s
	OVERALL LEVEL	1-20 KHZ
31	.154 In/Sec	.673 G-s
31L	.118 In/Sec	.583 G-s
	OVERALL LEVEL	1-20 KHz
51	.257 In/Sec	.412 G-s
51L	.257 In/Sec	.412 G-s
52	.067 In/Sec	.195 G-s
52L	.216 In/Sec	.210 G-s
53	.244 In/Sec	.089 G-s
53L	.164 In/Sec	.151 G-s
61	.157 In/Sec	.231 G-s
61L	.151 In/Sec	.231 G-s
81	.041 In/Sec	.038 G-s
82	.031 In/Sec	.013 G-s
83	.042 In/Sec	.013 G-s

Clarification Of Vibration Units:

Acc --> G-s PK

Vel --> In/Sec PK

As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,

ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

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