HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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September 19th, 2023

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Arkema
Memphis, TN

The following is a summary of findings from the September 2023 WEEK 3 vibration survey at the H2O2 Plant and the H2 WEEKLY FAN vibration survey that was performed on September 15th, 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.

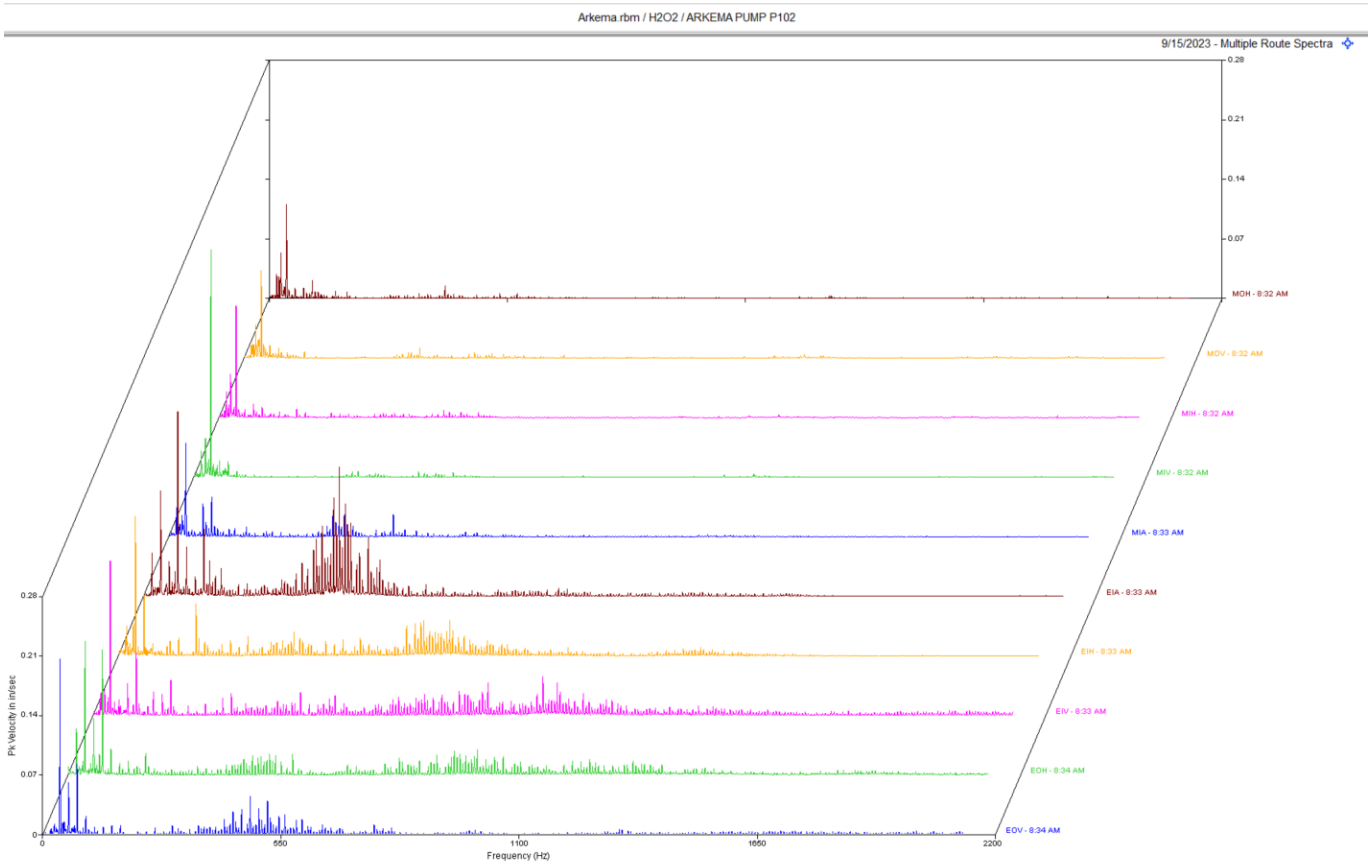
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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 3 H2O2 Plant

Pump 102 P102 CLASS I



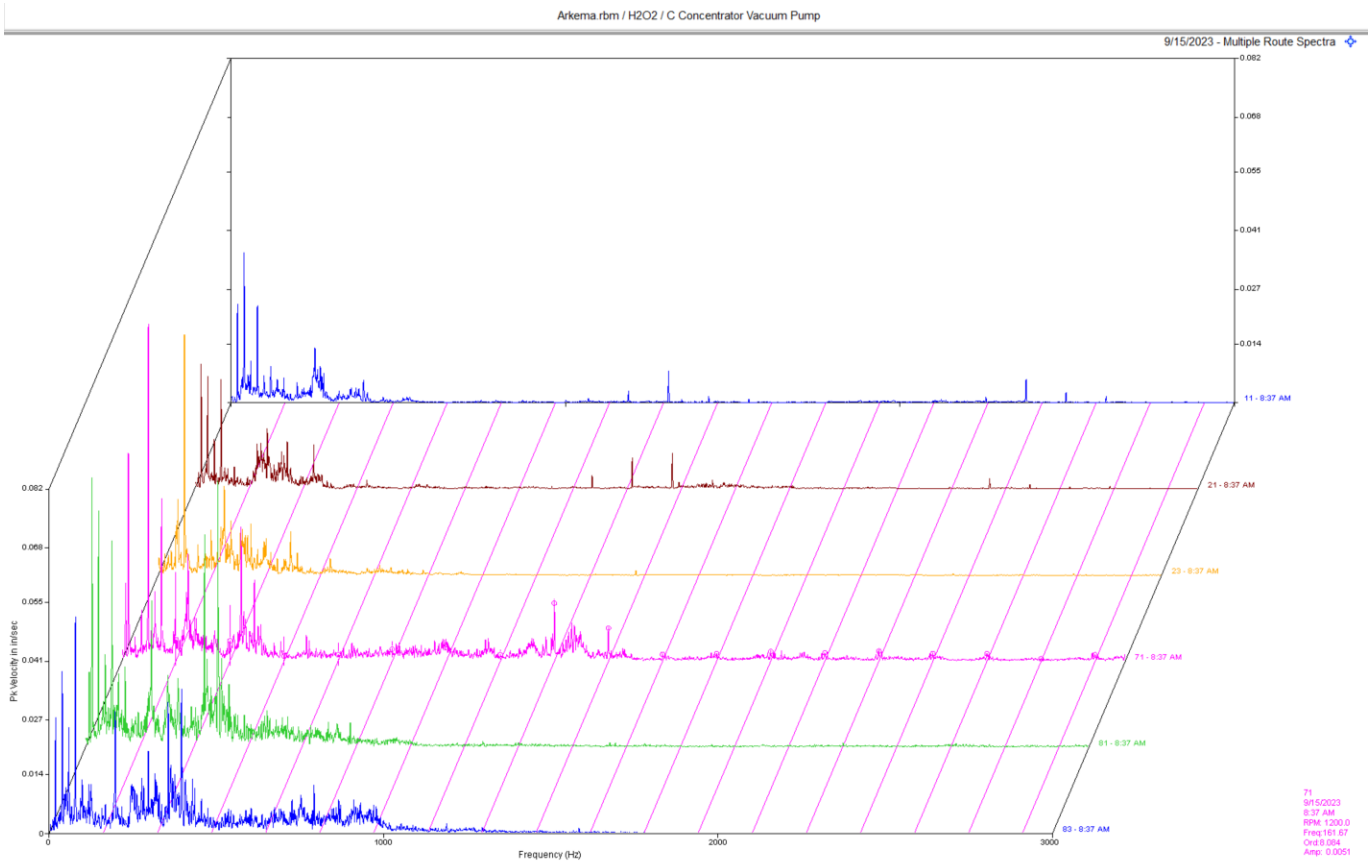
Observation:

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



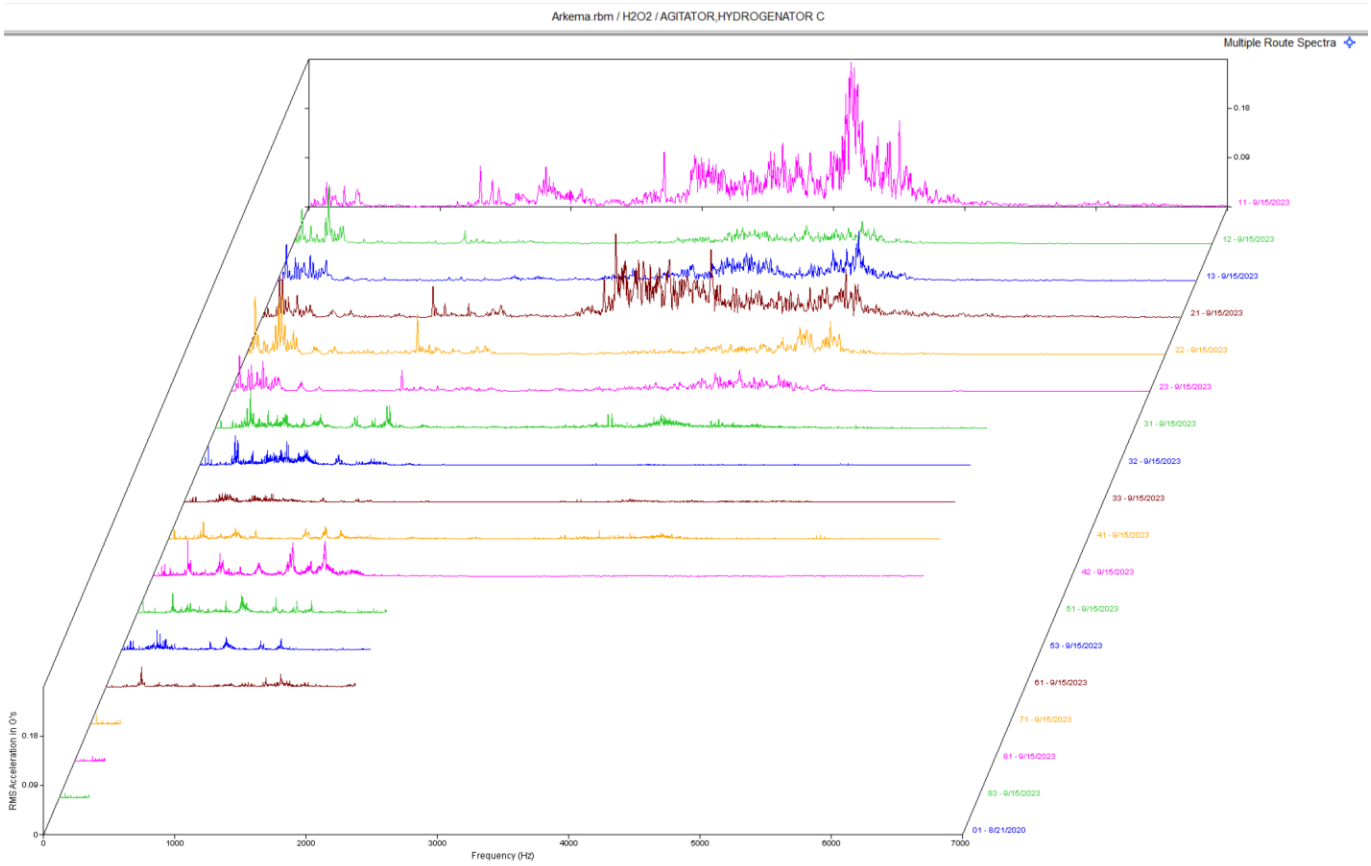
Observation:

Data above is a multipoint spectral waterfall. Data point labeled 71 is the pump drive end horizontal. The small peaks in mid to high range of the spectrum appear to be non-synchronous peaks and are likely bearing defect frequencies.

Recommendation:

The pump appears to have possible early stage bearing defects/wear. We are monitoring this issue closely.

Agitator, Hydrogenator C CLASS I



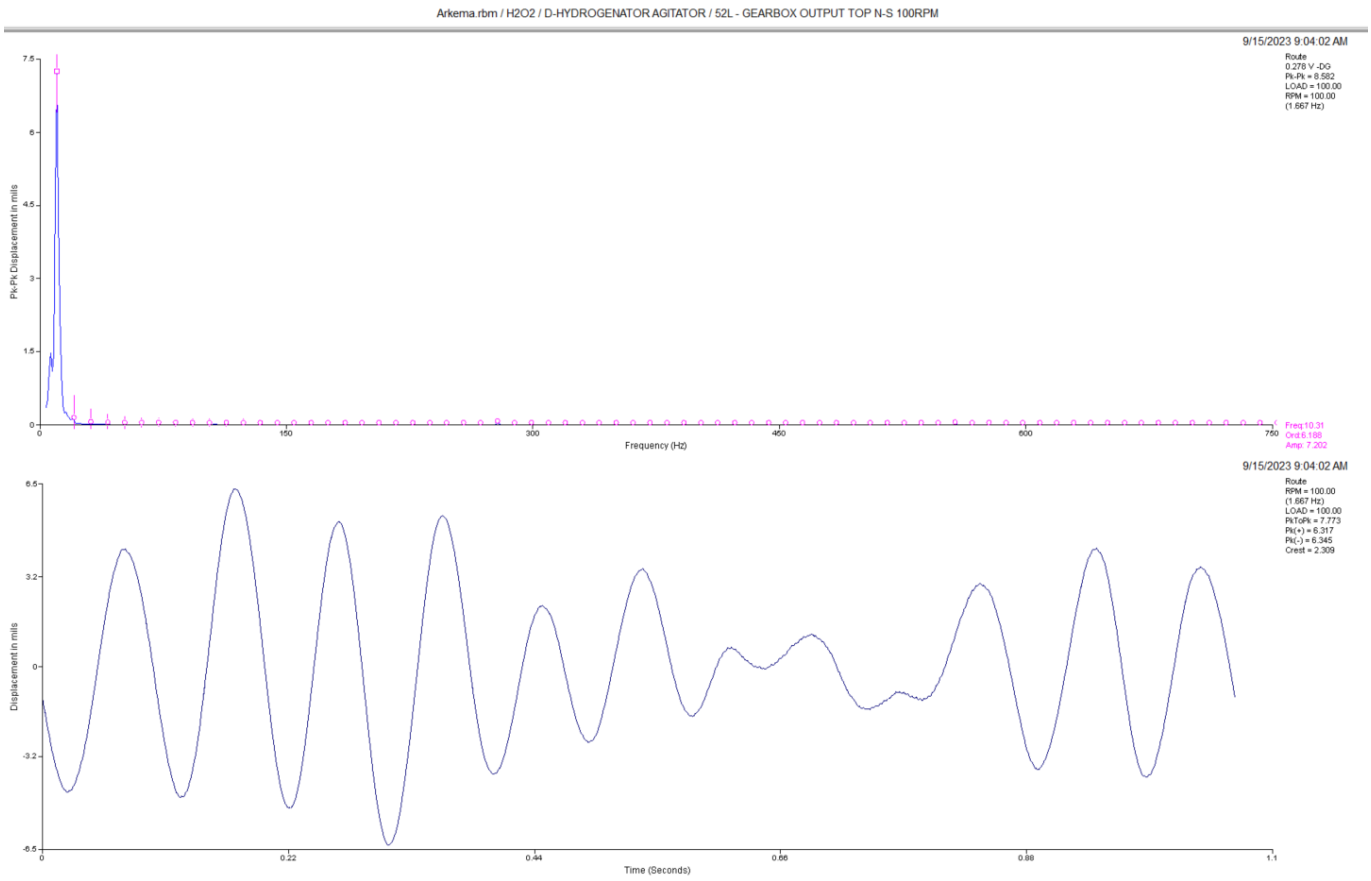
Observation:

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. This issue appears to be minor at this time and we are monitoring this closely.

D Hydrogenator Agitator **CLASS II**



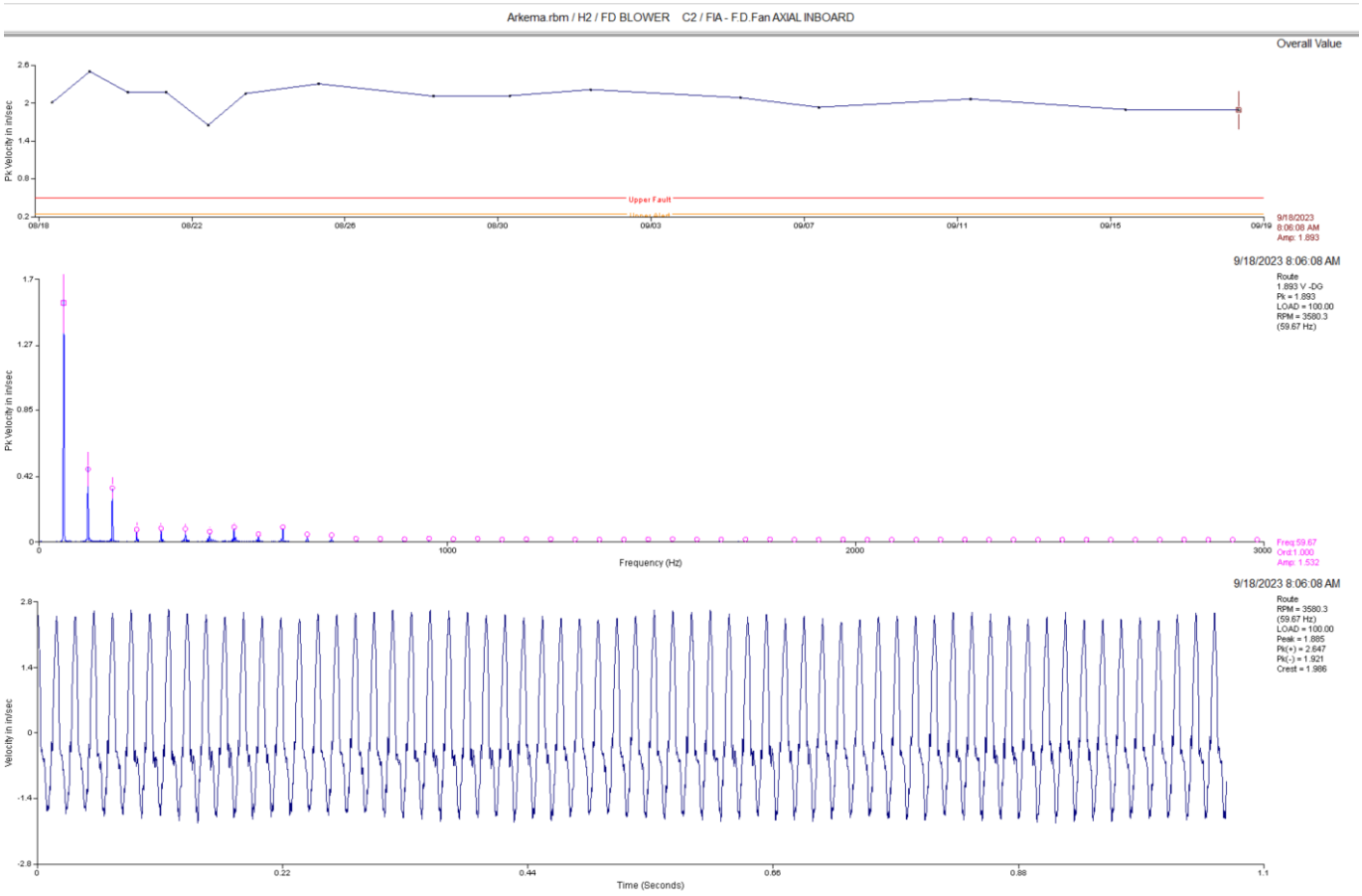
Observation:

Data above is the gearbox output top side. There is quite a bit of 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.

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.

FD Blower CLASS IV



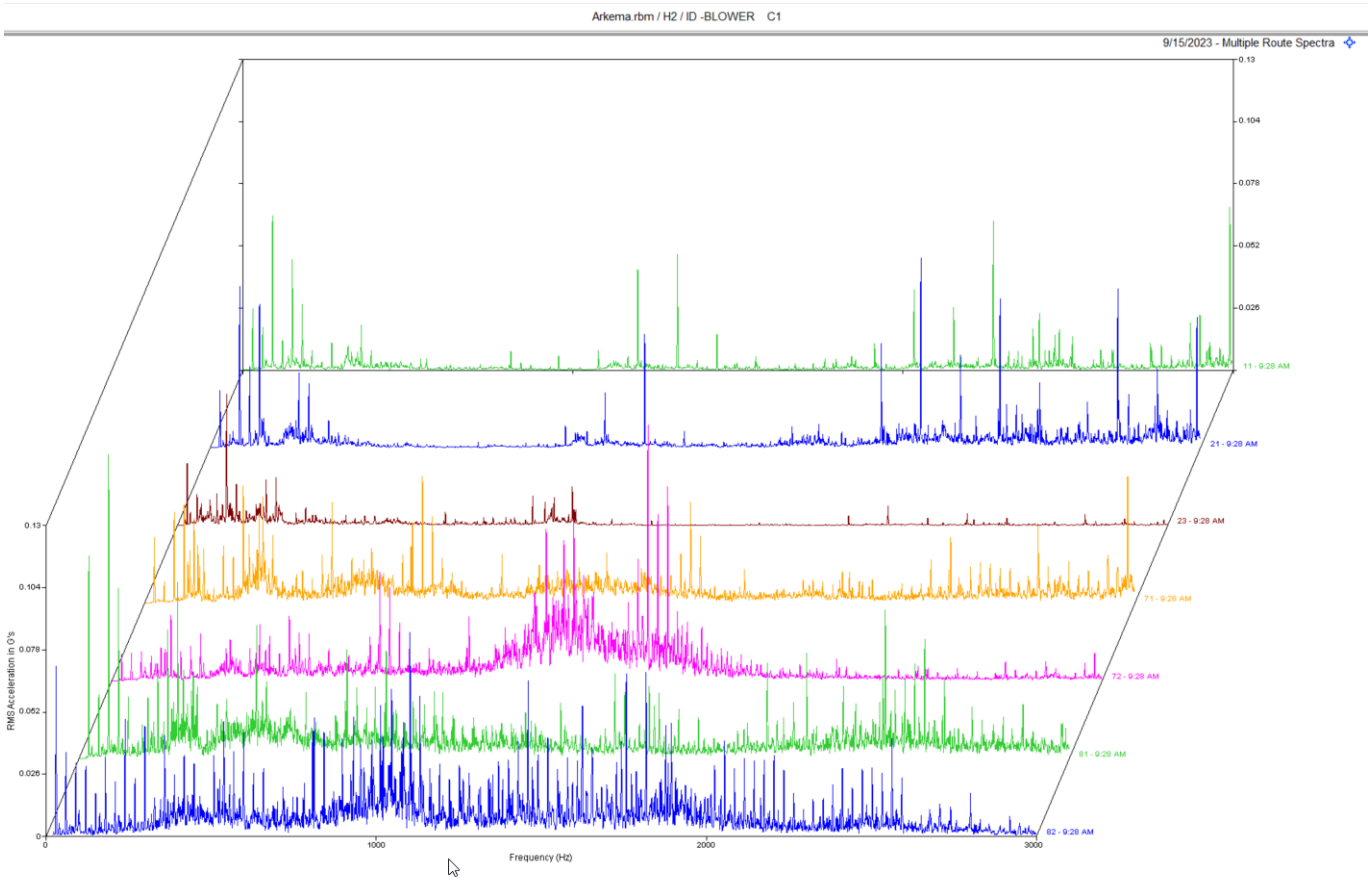
Observation:

Data above is the motor inboard axial. Data shows a high 1 x rpm with a smaller 2, 3, and 4 x rpm vibration. Vibration has increased significantly since replacing fan shaft and fan bearings. The shaft that in place right now has excessive run-out (.003 to .005" in various spots on shaft).

Recommendation:

Fan shaft and or the fan wheel is likely the issue here. We recommend replacing the fan shaft with a TGP 4140 (steel type) shaft. Replace bearings also. Ensure fan wheel is not warped or cracked. Fan wheel needs to be dynamically balanced with new shaft and coupling. **Replace ASAP due to high vibration.**

ID Blower CLASS II



Observation:

Data above is a multi-point spectrum of the motor and the fan Spectral data indicates bearing defects are present in the fan bearings.

Recommendation:

Not a lot of change since last survey. Fan bearings may need to be replaced in the next few months. Monitoring this issue closely.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 3: ARK WK 3

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
P102	- ARKEMA PUMP P102	(15-Sep-23)	
		OVERALL LEVEL	1K-20KHz
MOH		.144 In/Sec	.711 G-s
MOV		.132 In/Sec	.608 G-s
MIH		.158 In/Sec	.771 G-s
MIV		.286 In/Sec	.614 G-s
MIA		.170 In/Sec	.243 G-s
EIA		.481 In/Sec	.618 G-s
EIH		.284 In/Sec	1.342 G-s
EIV		.317 In/Sec	2.816 G-s
EOH		.309 In/Sec	4.298 G-s
EOV		.275 In/Sec	2.900 G-s
2130-1old	- C Concentrator Vacuum Pump	(15-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.075 In/Sec	.436 G-s
21		.083 In/Sec	.665 G-s
23		.105 In/Sec	.133 G-s
71		.169 In/Sec	2.990 G-s
81		.203 In/Sec	.552 G-s
83		.167 In/Sec	.413 G-s
7000-01	- AGITATOR,HYDROGENATOR C	(15-Sep-23)	
		OVERALL LEVEL	1-20 KHZ
02		.041 In/Sec	.011 G-s
03		.044 In/Sec	.0092 G-s
11		.076 In/Sec	1.391 G-s
12		.134 In/Sec	.319 G-s
13		.124 In/Sec	.508 G-s
21		.102 In/Sec	1.239 G-s
22		.201 In/Sec	.376 G-s
23		.121 In/Sec	.279 G-s
31		.074 In/Sec	.392 G-s
32		.092 In/Sec	.131 G-s
33		.049 In/Sec	.096 G-s
41		.057 In/Sec	.219 G-s
42		.089 In/Sec	.332 G-s
51		.056 In/Sec	.202 G-s
53		.055 In/Sec	.076 G-s
61		.029 In/Sec	.204 G-s
71		.054 In/Sec	.198 G-s
81		.024 In/Sec	.283 G-s
83		.045 In/Sec	.090 G-s
57	- A/B Concentr Vac Pmp-var RPM	(15-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.050 In/Sec	.341 G-s
12		.066 In/Sec	.193 G-s
21		.062 In/Sec	.486 G-s
23		.060 In/Sec	.167 G-s
71		.113 In/Sec	.467 G-s
81		.339 In/Sec	.921 G-s
83		.104 In/Sec	.500 G-s
2130-1	- FLASH VAP VAC PUMP-var speed	(15-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.051 In/Sec	.334 G-s
12		.040 In/Sec	.078 G-s
21		.045 In/Sec	.473 G-s

	22	.055 In/Sec	.114 G-s
	23	.048 In/Sec	.120 G-s
	71	.073 In/Sec	.627 G-s
	72	.071 In/Sec	.426 G-s
	81	.079 In/Sec	1.176 G-s
	82	.075 In/Sec	.591 G-s
	83	.046 In/Sec	.373 G-s

C-203 - C-203 Comp (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.078 In/Sec	3.459 G-s
12	.031 In/Sec	.928 G-s
21	.075 In/Sec	3.114 G-s
22	.035 In/Sec	1.167 G-s
23	.024 In/Sec	.562 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.053 In/Sec	3.372 G-s
72M	.039 In/Sec	1.096 G-s
73M	.069 In/Sec	1.108 G-s
81M	.045 In/Sec	8.775 G-s
82M	.033 In/Sec	1.778 G-s
71F	.035 In/Sec	3.319 G-s
72F	.054 In/Sec	1.378 G-s
73F	.026 In/Sec	.818 G-s
81F	.039 In/Sec	2.978 G-s
82F	.036 In/Sec	1.151 G-s

C-202 - C-202 Comp (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.085 In/Sec	3.097 G-s
12	.151 In/Sec	1.137 G-s
21	.070 In/Sec	.868 G-s
22	.061 In/Sec	.480 G-s
23	.047 In/Sec	.253 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.069 In/Sec	4.167 G-s
72M	.040 In/Sec	1.136 G-s
73M	.092 In/Sec	1.251 G-s
81M	.050 In/Sec	6.399 G-s
82M	.049 In/Sec	.975 G-s
71F	.034 In/Sec	3.872 G-s
72F	.064 In/Sec	1.015 G-s
73F	.042 In/Sec	1.128 G-s
81F	.043 In/Sec	14.05 G-s
82F	.046 In/Sec	1.189 G-s

C-201 - C-201 Comp (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.095 In/Sec	1.326 G-s
12	.069 In/Sec	1.975 G-s
21	.110 In/Sec	1.154 G-s
22	.039 In/Sec	.190 G-s
23	.056 In/Sec	.190 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.052 In/Sec	4.048 G-s
72M	.040 In/Sec	.929 G-s
73M	.070 In/Sec	1.189 G-s
81M	.041 In/Sec	7.026 G-s
82M	.029 In/Sec	.818 G-s
71F	.036 In/Sec	10.32 G-s
72F	.052 In/Sec	1.848 G-s
73F	.038 In/Sec	1.270 G-s
81F	.039 In/Sec	5.173 G-s
82F	.055 In/Sec	2.146 G-s

new AC - INSTRUMENT AIR COMPRESSOR (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.091 In/Sec	1.098 G-s
12	.111 In/Sec	.503 G-s
13	.067 In/Sec	.240 G-s

	21	.083 In/Sec	1.609 G-s
	22	.076 In/Sec	.617 G-s
	23	.034 In/Sec	.321 G-s
		OVERALL LEVEL	1-20 KHZ
	71F	.118 In/Sec	7.301 G-s
	72F	.088 In/Sec	1.694 G-s
	73F	.061 In/Sec	1.825 G-s
	81F	.133 In/Sec	3.705 G-s
	82F	.161 In/Sec	1.409 G-s
	83F	.218 In/Sec	1.597 G-s
	71M	.119 In/Sec	9.951 G-s
	72M	.096 In/Sec	1.979 G-s
	73M	.103 In/Sec	2.163 G-s
	81M	.121 In/Sec	7.361 G-s
	82M	.288 In/Sec	2.210 G-s
	83M	.128 In/Sec	1.687 G-s

201-08A - COMPRESSOR,NASH A 201-08A (15-Sep-23)

		OVERALL LEVEL	1-20 KHz
	11	.048 In/Sec	.152 G-s
	12	.051 In/Sec	.124 G-s
	13	.112 In/Sec	.121 G-s
	21	.046 In/Sec	.108 G-s
	22	.050 In/Sec	.069 G-s
	23	.145 In/Sec	.162 G-s
	71	.145 In/Sec	.670 G-s
	72	.171 In/Sec	.111 G-s
	73	.114 In/Sec	.140 G-s
	81	.148 In/Sec	.306 G-s
	82	.163 In/Sec	.050 G-s
	83	.118 In/Sec	.063 G-s

9002-10 - D-HYDROGENATOR AGITATOR (15-Sep-23)

		OVERALL LEVEL	1-20 KHz
	11	.085 In/Sec	.212 G-s
	21	.082 In/Sec	.317 G-s
	23	.076 In/Sec	.043 G-s
		OVERALL LEVEL	1-20 KHZ
	31	.177 In/Sec	.621 G-s
	31L	.174 In/Sec	.585 G-s
		OVERALL LEVEL	1-20 KHz
	51	.111 In/Sec	.223 G-s
	51L	.111 In/Sec	.223 G-s
	52	.065 In/Sec	.333 G-s
	52L	.278 In/Sec	.431 G-s
	53	.216 In/Sec	.187 G-s
	53L	.219 In/Sec	.238 G-s
	61	.162 In/Sec	.175 G-s
	61L	.364 In/Sec	.175 G-s
	81	.037 In/Sec	.030 G-s
	82	.027 In/Sec	.038 G-s
	83	.030 In/Sec	.011 G-s

NTC-SF - N CT-SOUTH FAN, N TWR (15-Sep-23)

		OVERALL LEVEL	1-20 KHz
	1	.376 In/Sec	.590 G-s
	2	.246 In/Sec	.532 G-s
	3	.177 In/Sec	.587 G-s
		OVERALL LEVEL	1-20 KHZ
	4	.294 In/Sec	.383 G-s
	5	.0070 In/Sec	.0011 G-s
	6	.272 In/Sec	.480 G-s

NCT - NF - N CT -NORTH FAN, N TWR (15-Sep-23)

		OVERALL LEVEL	1-20 KHz
	7	.289 In/Sec	.962 G-s
	8	.208 In/Sec	.456 G-s
	9	.280 In/Sec	.403 G-s
		OVERALL LEVEL	1-20 KHZ
	10	.206 In/Sec	.353 G-s

	11	.239 In/Sec	.289 G-s
	12	.168 In/Sec	.393 G-s

530-01 - PUMP,N.COOLING TWR,NORTH (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.269 In/Sec	2.913 G-s
12	.150 In/Sec	.614 G-s

530-02 - PUMP,N.COOLING TWR,MIDDLE (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.125 In/Sec	1.680 G-s
12	.187 In/Sec	1.763 G-s

548-7 - IRON-FREE H2O BOOSTER PUMP (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.025 In/Sec	.714 G-s
21	.030 In/Sec	.607 G-s
23	.039 In/Sec	.690 G-s
71	.045 In/Sec	.157 G-s
72	.027 In/Sec	.301 G-s

STC-NF - S CT - NORTH FAN, S TWR (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
1	.253 In/Sec	.871 G-s
2	.240 In/Sec	.356 G-s
3	.224 In/Sec	.191 G-s
	OVERALL LEVEL	1-20 KHZ
4	.146 In/Sec	.344 G-s
5	.122 In/Sec	.449 G-s

STC-MF - S CT - MID FAN, S TWR (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
1	.269 In/Sec	.911 G-s
2	.230 In/Sec	.222 G-s
3	.187 In/Sec	.112 G-s
	OVERALL LEVEL	1-20 KHZ
4	.095 In/Sec	.281 G-s
5	.123 In/Sec	.402 G-s
6	.121 In/Sec	.517 G-s

STC-SF - S CT - SOUTH FAN, S TWR (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
1	.193 In/Sec	.385 G-s
2	.263 In/Sec	.236 G-s
3	.231 In/Sec	.104 G-s
	OVERALL LEVEL	1-20 KHZ
4	.126 In/Sec	.506 G-s
5	.101 In/Sec	.463 G-s
6	.350 In/Sec	.657 G-s

SCT-1 - SOUTH CT PUMP - EAST (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.079 In/Sec	2.462 G-s
21	.089 In/Sec	2.641 G-s
23	.063 In/Sec	.724 G-s
71	.164 In/Sec	1.299 G-s
72	.103 In/Sec	2.330 G-s

SCT-2 - SOUTH CT PUMP - MID (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.122 In/Sec	2.914 G-s
21	.079 In/Sec	1.852 G-s
23	.094 In/Sec	1.202 G-s
71	.148 In/Sec	1.070 G-s
72	.053 In/Sec	1.209 G-s

SCT-3 - SOUTH CT PUMP - WEST (15-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.071 In/Sec	1.261 G-s
21	.054 In/Sec	.631 G-s

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          23                        .092 In/Sec       1.089 G-s
          71                        .108 In/Sec       2.276 G-s
          72                        .158 In/Sec       1.639 G-s


            Database:  Arkema.rbm
            Station:   HYDROGEN
            Route No.  2:  H2 WEEKLY

     MEASUREMENT POINT             OVERALL LEVEL       HFD / VHFD
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     C2         - FD BLOWER    C2                (18-Sep-23)
                                  OVERALL LEVEL      1-20 KHz
          MOH                       .651 In/Sec        .992 G-s
          MOV                       .587 In/Sec        .583 G-s
          MIH                       .390 In/Sec       1.289 G-s
          MIV                       .539 In/Sec        .289 G-s
          MIA                      1.402 In/Sec        .247 G-s
          FIH                       .548 In/Sec       2.173 G-s
          FIV                       .964 In/Sec        .753 G-s
          FIA                      1.893 In/Sec        .651 G-s
          FOH                       .498 In/Sec       2.416 G-s
          FOV                      1.362 In/Sec        .498 G-s

     C1         - ID -BLOWER    C1                (15-Sep-23)
                                  OVERALL LEVEL      1-20 KHz
          11                        .112 In/Sec        .464 G-s
          21                        .116 In/Sec        .442 G-s
          23                        .099 In/Sec        .095 G-s
          71                        .113 In/Sec        .661 G-s
          72                        .061 In/Sec        .467 G-s
          81                        .297 In/Sec       1.889 G-s
          82                        .227 In/Sec        .623 G-s

-------------------------------------------------------------------------------
   Clarification Of Vibration Units:
      Acc       -->  G-s       PK
      Vel       -->  In/Sec    PK
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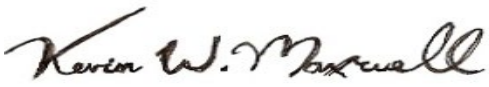
As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

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