HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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August 23rd, 2023

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Arkema
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The following is a summary of findings from the August 2023 WEEK 3 vibration survey at the H2O2 Plant and the H2 WEEKLY FAN vibration survey that was performed on August 18th, 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.

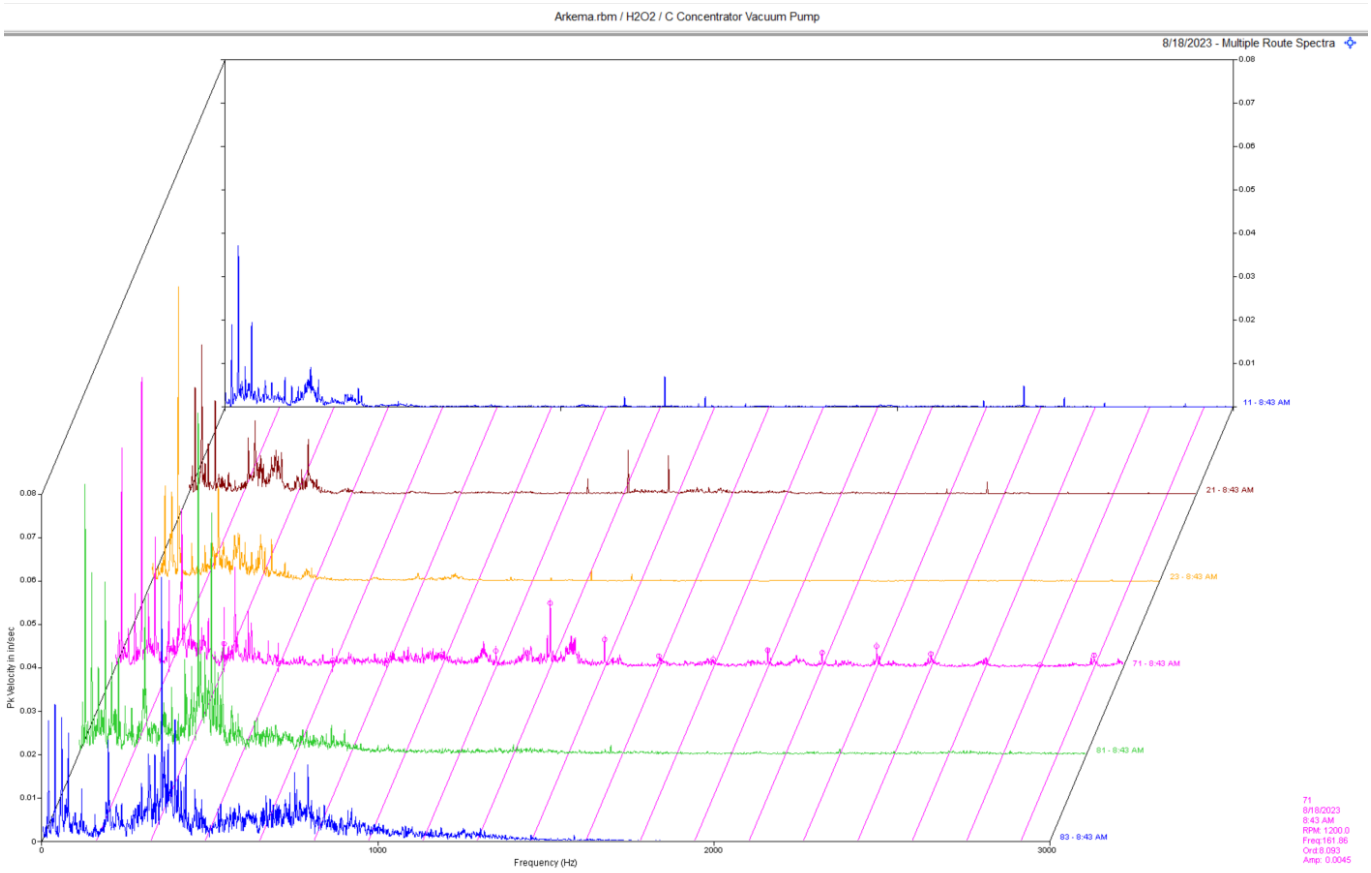
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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

C Concentrator Vacuum Pump CLASS I



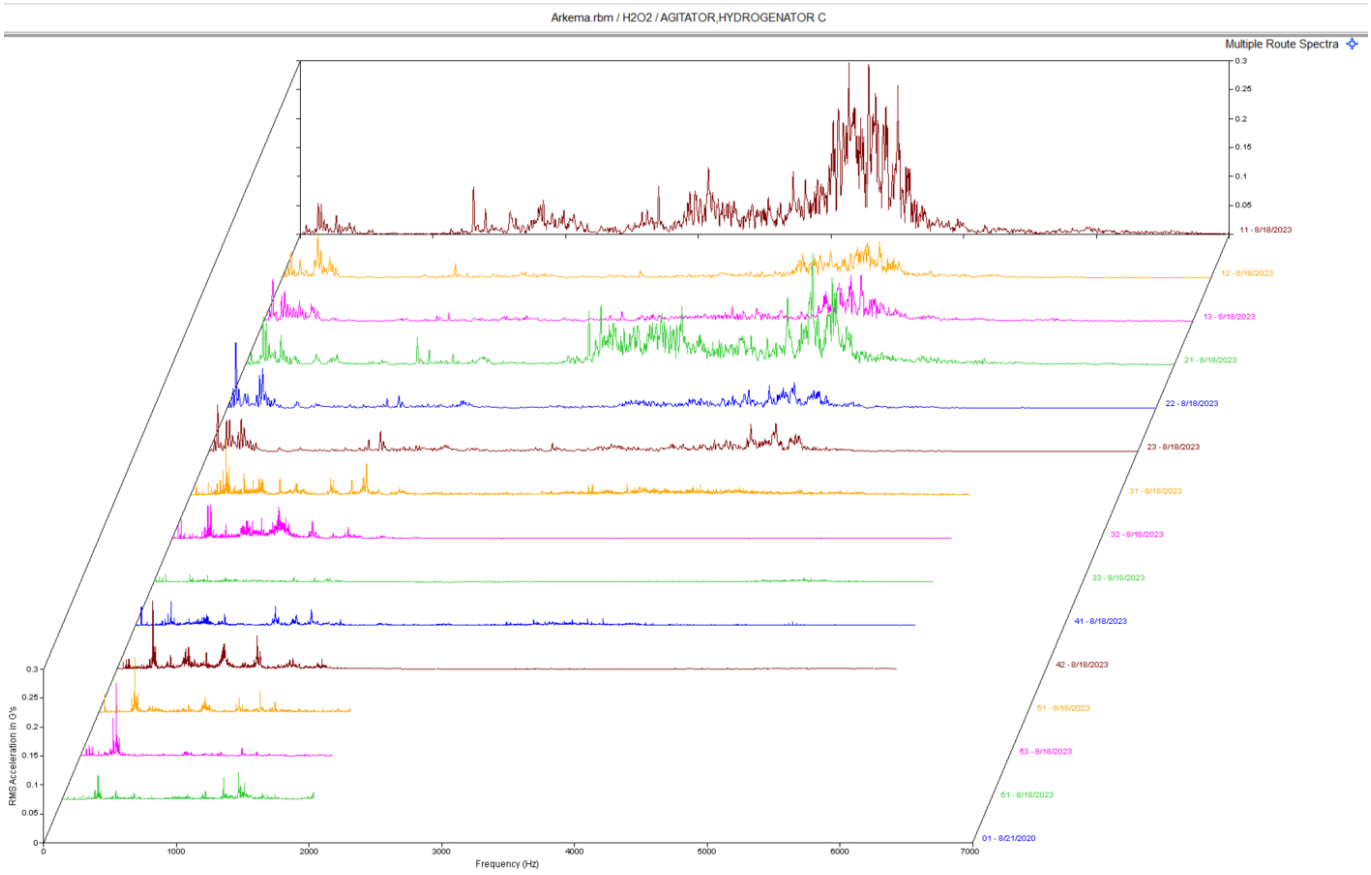
Observation:

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 are non-synchronous peaks and are very likely bearing defect frequencies.

Recommendation:

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

Agitator, Hydrogenator C **CLASS I**



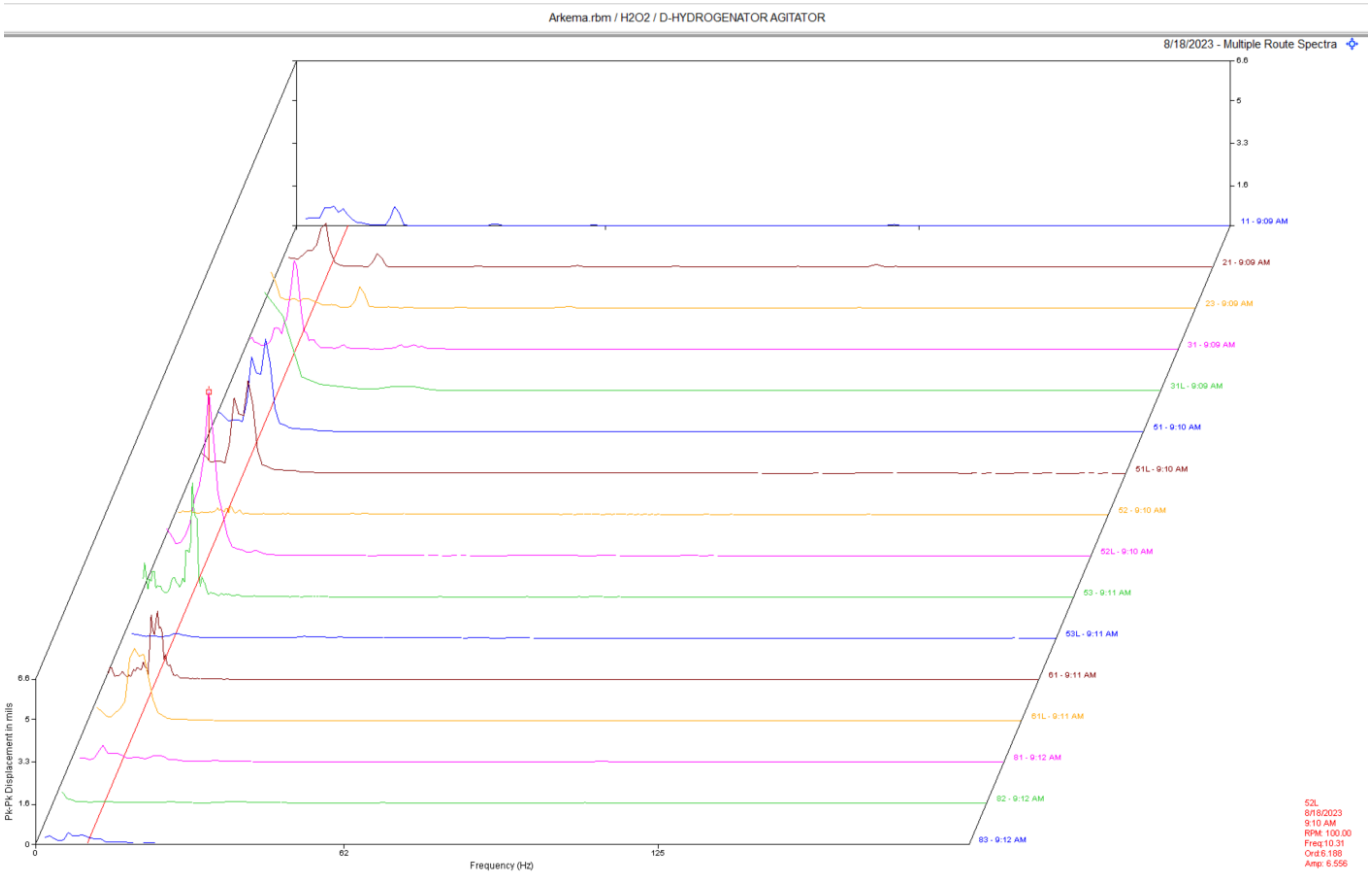
Observation:

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. 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



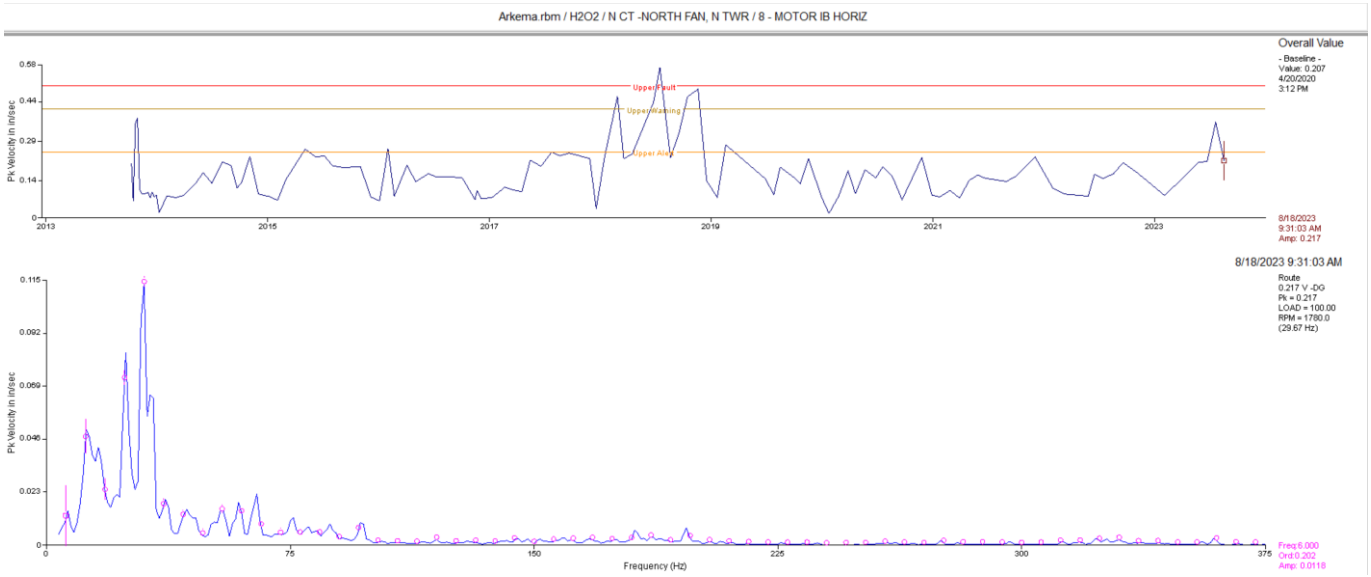
Observation:

Data above is a multi-point spectra of the motor and gear drive. 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.

North Fan@North CT Tower CLASS II



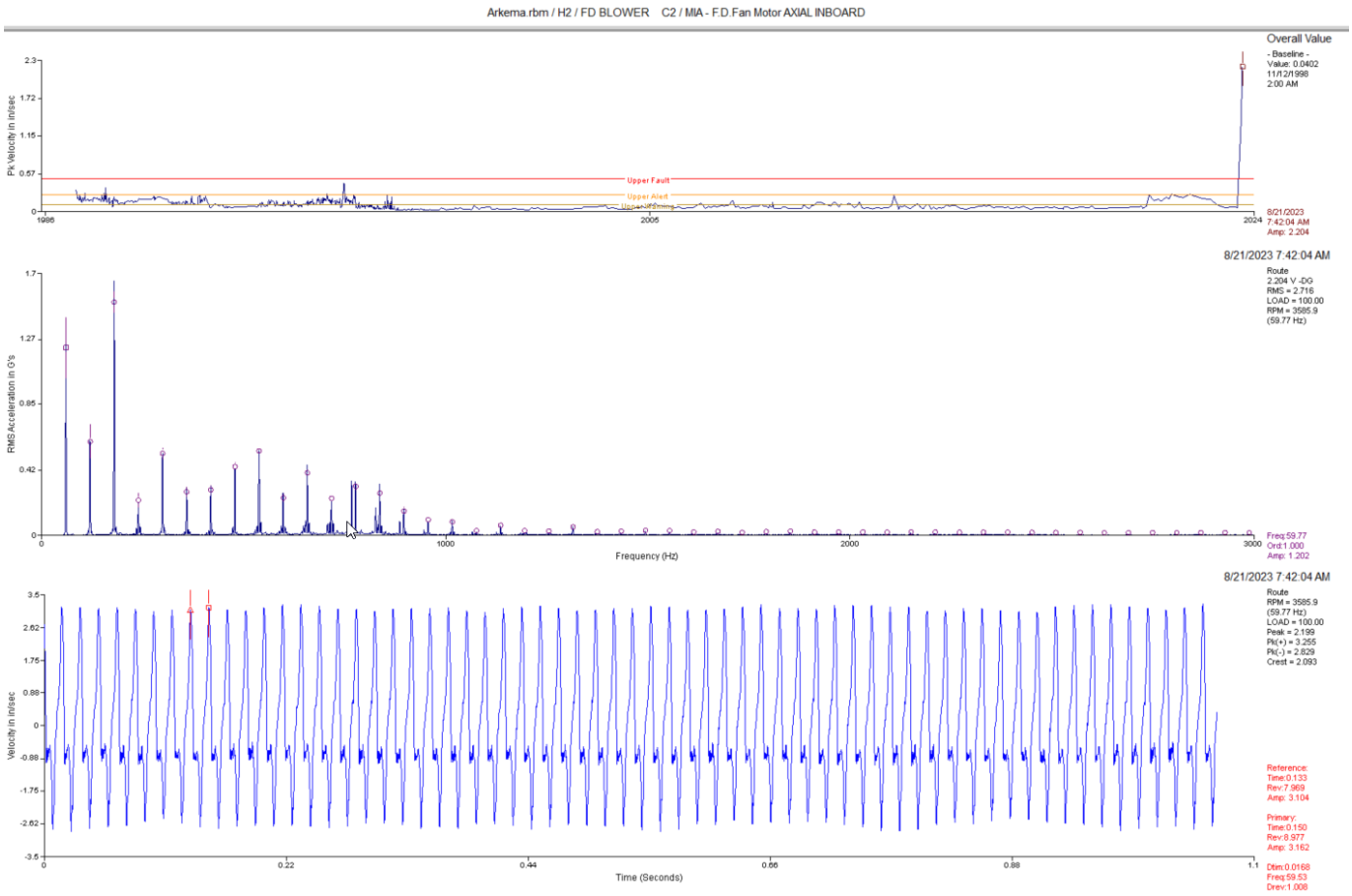
Observation:

Motor inboard still has sub-synchronous vibrations, but overall amplitude is lower according to recent trend data.

Recommendation:

We still recommend to check drive train components such belts, couplings, etc. for wear as time allows.

FD Blower CLASS IV



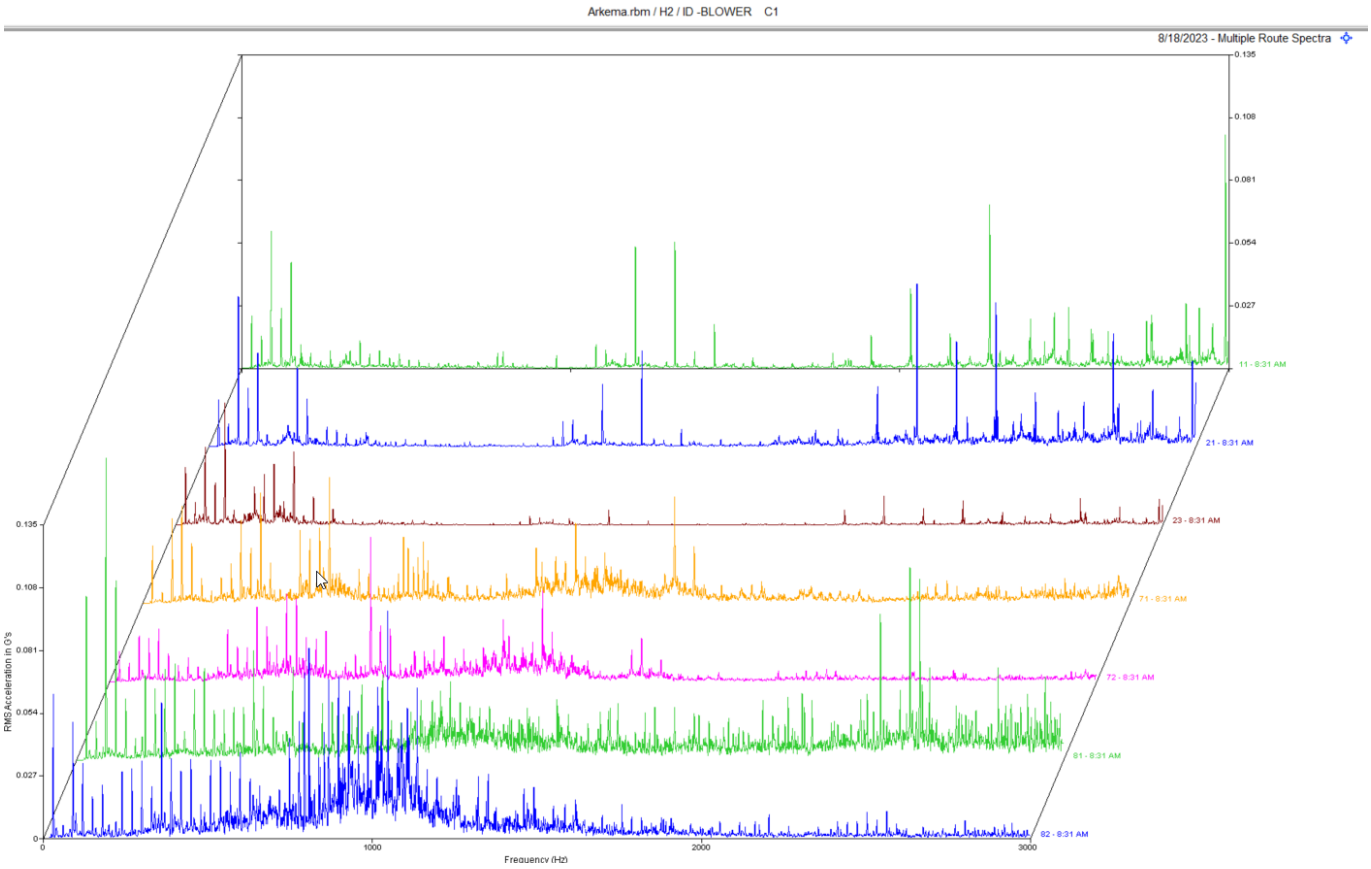
Observation:

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	(18-Aug-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.082 In/Sec	.437 G-s
MOV	.085 In/Sec	.306 G-s
MIH	.084 In/Sec	.527 G-s
MIV	.263 In/Sec	.478 G-s
MIA	.091 In/Sec	.290 G-s
EIA	.193 In/Sec	.851 G-s
EIH	.300 In/Sec	.595 G-s
EIV	.245 In/Sec	1.653 G-s
EOH	.147 In/Sec	1.017 G-s
EOV	.139 In/Sec	.650 G-s
2130-1old - C Concentrator Vacuum Pump	(18-Aug-23)	
	OVERALL LEVEL	1-20 KHz
11	.069 In/Sec	.387 G-s
21	.084 In/Sec	.471 G-s
23	.115 In/Sec	.152 G-s
71	.156 In/Sec	2.977 G-s
81	.214 In/Sec	.633 G-s
83	.187 In/Sec	.642 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(18-Aug-23)	
	OVERALL LEVEL	1-20 KHZ
02	.042 In/Sec	.032 G-s
03	.052 In/Sec	.0090 G-s
11	.081 In/Sec	2.172 G-s
12	.107 In/Sec	.522 G-s
13	.136 In/Sec	.585 G-s
21	.101 In/Sec	1.044 G-s
22	.190 In/Sec	.268 G-s
23	.143 In/Sec	.280 G-s
31	.076 In/Sec	.350 G-s
32	.093 In/Sec	.095 G-s
33	.048 In/Sec	.107 G-s
41	.074 In/Sec	.178 G-s
42	.091 In/Sec	.163 G-s
51	.078 In/Sec	.191 G-s
53	.077 In/Sec	.058 G-s
61	.031 In/Sec	.221 G-s
71	.061 In/Sec	.209 G-s
81	.026 In/Sec	.214 G-s
83	.048 In/Sec	.054 G-s
57 - A/B Concentr Vac Pmp-var RPM	(18-Aug-23)	
	OVERALL LEVEL	1-20 KHz
11	.044 In/Sec	.263 G-s
12	.045 In/Sec	.072 G-s
21	.058 In/Sec	.276 G-s
23	.045 In/Sec	.098 G-s
71	.110 In/Sec	.399 G-s
81	.298 In/Sec	.582 G-s
83	.091 In/Sec	.645 G-s
2130-1 - FLASH VAP VAC PUMP-var speed	(18-Aug-23)	
	OVERALL LEVEL	1-20 KHz
11	.049 In/Sec	.706 G-s
12	.039 In/Sec	.206 G-s
21	.049 In/Sec	.488 G-s

	22	.059 In/Sec	.117 G-s
	23	.059 In/Sec	.131 G-s
	71	.071 In/Sec	.736 G-s
	72	.069 In/Sec	.250 G-s
	81	.075 In/Sec	.999 G-s
	82	.080 In/Sec	.736 G-s
	83	.051 In/Sec	.686 G-s

C-203 - C-203 Comp (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.049 In/Sec	2.262 G-s
12	.031 In/Sec	.983 G-s
21	.056 In/Sec	2.269 G-s
22	.030 In/Sec	.937 G-s
23	.023 In/Sec	.614 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.074 In/Sec	4.348 G-s
72M	.048 In/Sec	1.334 G-s
73M	.101 In/Sec	1.118 G-s
81M	.039 In/Sec	9.947 G-s
82M	.029 In/Sec	1.515 G-s
71F	.042 In/Sec	3.007 G-s
72F	.062 In/Sec	.849 G-s
73F	.032 In/Sec	.922 G-s
81F	.038 In/Sec	3.536 G-s
82F	.031 In/Sec	1.485 G-s

C-202 - C-202 Comp (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.177 In/Sec	7.369 G-s
12	.146 In/Sec	1.427 G-s
21	.070 In/Sec	1.061 G-s
22	.062 In/Sec	.510 G-s
23	.049 In/Sec	.290 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.049 In/Sec	4.271 G-s
72M	.028 In/Sec	.731 G-s
73M	.079 In/Sec	1.163 G-s
81M	.044 In/Sec	7.616 G-s
82M	.039 In/Sec	1.190 G-s
71F	.028 In/Sec	9.160 G-s
72F	.063 In/Sec	1.578 G-s
73F	.043 In/Sec	1.866 G-s
81F	.036 In/Sec	5.126 G-s
82F	.046 In/Sec	.629 G-s

C-201 - C-201 Comp (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.104 In/Sec	1.793 G-s
12	.067 In/Sec	1.740 G-s
21	.107 In/Sec	1.068 G-s
22	.040 In/Sec	.244 G-s
23	.063 In/Sec	.096 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.061 In/Sec	4.242 G-s
72M	.030 In/Sec	.697 G-s
73M	.070 In/Sec	.776 G-s
81M	.041 In/Sec	4.115 G-s
82M	.024 In/Sec	.713 G-s
71F	.034 In/Sec	7.447 G-s
72F	.057 In/Sec	1.659 G-s
73F	.024 In/Sec	1.398 G-s
81F	.047 In/Sec	11.29 G-s
82F	.060 In/Sec	1.774 G-s

new AC - INSTRUMENT AIR COMPRESSOR (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.096 In/Sec	1.373 G-s
12	.105 In/Sec	.543 G-s
13	.054 In/Sec	.243 G-s

	21	.071 In/Sec	1.411 G-s
	22	.071 In/Sec	.581 G-s
	23	.042 In/Sec	.225 G-s
		OVERALL LEVEL	1-20 KHZ
	71F	.098 In/Sec	5.277 G-s
	72F	.098 In/Sec	1.744 G-s
	73F	.058 In/Sec	2.393 G-s
	81F	.116 In/Sec	3.979 G-s
	82F	.308 In/Sec	1.331 G-s
	83F	.131 In/Sec	1.483 G-s
	71M	.118 In/Sec	8.976 G-s
	72M	.084 In/Sec	2.152 G-s
	73M	.061 In/Sec	1.046 G-s
	81M	.130 In/Sec	6.491 G-s
	82M	.271 In/Sec	2.515 G-s
	83M	.201 In/Sec	2.074 G-s

201-08A - COMPRESSOR,NASH A 201-08A (18-Aug-23)

OVERALL LEVEL		1-20 KHz
11	.062 In/Sec	.133 G-s
12	.059 In/Sec	.103 G-s
13	.111 In/Sec	.081 G-s
21	.209 In/Sec	.120 G-s
22	.060 In/Sec	.061 G-s
23	.137 In/Sec	.117 G-s
71	.147 In/Sec	.556 G-s
72	.179 In/Sec	.127 G-s
73	.130 In/Sec	.147 G-s
81	.160 In/Sec	.297 G-s
82	.184 In/Sec	.059 G-s
83	.126 In/Sec	.068 G-s

9002-10 - D-HYDROGENATOR AGITATOR (18-Aug-23)

OVERALL LEVEL		1-20 KHz
11	.068 In/Sec	.260 G-s
21	.087 In/Sec	.357 G-s
23	.069 In/Sec	.087 G-s
OVERALL LEVEL		1-20 KHZ
31	.195 In/Sec	.793 G-s
31L	.136 In/Sec	.675 G-s
OVERALL LEVEL		1-20 KHz
51	.185 In/Sec	.299 G-s
51L	.185 In/Sec	.299 G-s
52	.056 In/Sec	.226 G-s
52L	.286 In/Sec	.404 G-s
53	.254 In/Sec	.190 G-s
53L	.230 In/Sec	.223 G-s
61	.182 In/Sec	.236 G-s
61L	.155 In/Sec	.236 G-s
81	.040 In/Sec	.033 G-s
82	.028 In/Sec	.039 G-s
83	.032 In/Sec	.0070 G-s

NTC-SF - N CT-SOUTH FAN, N TWR (18-Aug-23)

OVERALL LEVEL		1-20 KHz
1	.370 In/Sec	.568 G-s
2	.232 In/Sec	.494 G-s
3	.197 In/Sec	.495 G-s
OVERALL LEVEL		1-20 KHZ
4	.244 In/Sec	.432 G-s
5	.0066 In/Sec	.0012 G-s
6	.217 In/Sec	.561 G-s

NCT - NF - N CT -NORTH FAN, N TWR (18-Aug-23)

OVERALL LEVEL		1-20 KHz
7	.299 In/Sec	.576 G-s
8	.217 In/Sec	.426 G-s
9	.191 In/Sec	.332 G-s
OVERALL LEVEL		1-20 KHZ
10	.187 In/Sec	.324 G-s

	11	.199 In/Sec	.284 G-s
	12	.169 In/Sec	.370 G-s

530-01 - PUMP,N.COOLING TWR,NORTH (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.357 In/Sec	3.593 G-s
12	.179 In/Sec	.635 G-s

530-02 - PUMP,N.COOLING TWR,MIDDLE (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.086 In/Sec	1.525 G-s
12	.164 In/Sec	1.325 G-s

548-7 - IRON-FREE H2O BOOSTER PUMP (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.034 In/Sec	.740 G-s
21	.037 In/Sec	.866 G-s
23	.051 In/Sec	.465 G-s
71	.086 In/Sec	.187 G-s
72	.047 In/Sec	.229 G-s

STC-NF - S CT - NORTH FAN, S TWR (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
1	.299 In/Sec	.372 G-s
2	.255 In/Sec	.222 G-s
3	.218 In/Sec	.157 G-s
	OVERALL LEVEL	1-20 KHZ
4	.130 In/Sec	.392 G-s
5	.154 In/Sec	.517 G-s

STC-MF - S CT - MID FAN, S TWR (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
1	.270 In/Sec	.476 G-s
2	.212 In/Sec	.074 G-s
3	.140 In/Sec	.091 G-s
	OVERALL LEVEL	1-20 KHZ
4	.111 In/Sec	.321 G-s
5	.089 In/Sec	.439 G-s
6	.132 In/Sec	.559 G-s

STC-SF - S CT - SOUTH FAN, S TWR (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
1	.201 In/Sec	.327 G-s
2	.255 In/Sec	.204 G-s
3	.267 In/Sec	.098 G-s
	OVERALL LEVEL	1-20 KHZ
4	.127 In/Sec	.540 G-s
5	.130 In/Sec	.470 G-s
6	.353 In/Sec	.620 G-s

SCT-1 - SOUTH CT PUMP - EAST (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.067 In/Sec	1.901 G-s
21	.068 In/Sec	1.157 G-s
23	.079 In/Sec	1.327 G-s
71	.181 In/Sec	1.682 G-s
72	.200 In/Sec	1.657 G-s

SCT-2 - SOUTH CT PUMP - MID (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.065 In/Sec	1.736 G-s
21	.041 In/Sec	.974 G-s
23	.113 In/Sec	1.149 G-s
71	.093 In/Sec	1.084 G-s
72	.077 In/Sec	1.777 G-s

SCT-3 - SOUTH CT PUMP - WEST (18-Aug-23)

	OVERALL LEVEL	1-20 KHz
11	.098 In/Sec	2.304 G-s
21	.054 In/Sec	.363 G-s

23	.131 In/Sec	.748 G-s
71	.145 In/Sec	2.360 G-s
72	.131 In/Sec	1.638 G-s

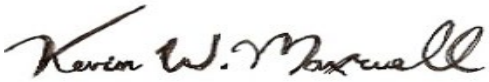
Route No. 2: H2 WEEKLY

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
C2 - FD BLOWER	C2 (21-Aug-23)	
	OVERALL LEVEL	1-20 KHz
MOH	.676 In/Sec	1.099 G-s
MOV	.664 In/Sec	.366 G-s
MIH	.572 In/Sec	1.259 G-s
MIV	1.320 In/Sec	.312 G-s
MIA	2.204 In/Sec	.254 G-s
FIH	.692 In/Sec	3.786 G-s
FIV	1.276 In/Sec	3.946 G-s
FIA	2.177 In/Sec	1.121 G-s
FOH	.838 In/Sec	4.168 G-s
FOV	1.973 In/Sec	.705 G-s
C1 - ID -BLOWER	C1 (18-Aug-23)	
	OVERALL LEVEL	1-20 KHz
11	.103 In/Sec	.456 G-s
21	.100 In/Sec	.428 G-s
23	.096 In/Sec	.092 G-s
71	.098 In/Sec	.384 G-s
72	.060 In/Sec	.209 G-s
81	.261 In/Sec	.849 G-s
82	.201 In/Sec	.428 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

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