HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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September 14th, 2023

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The following is a summary of findings from the August 2023 WEEK 2 vibration survey at the H2O2 Plant that was performed on September 7th, 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.

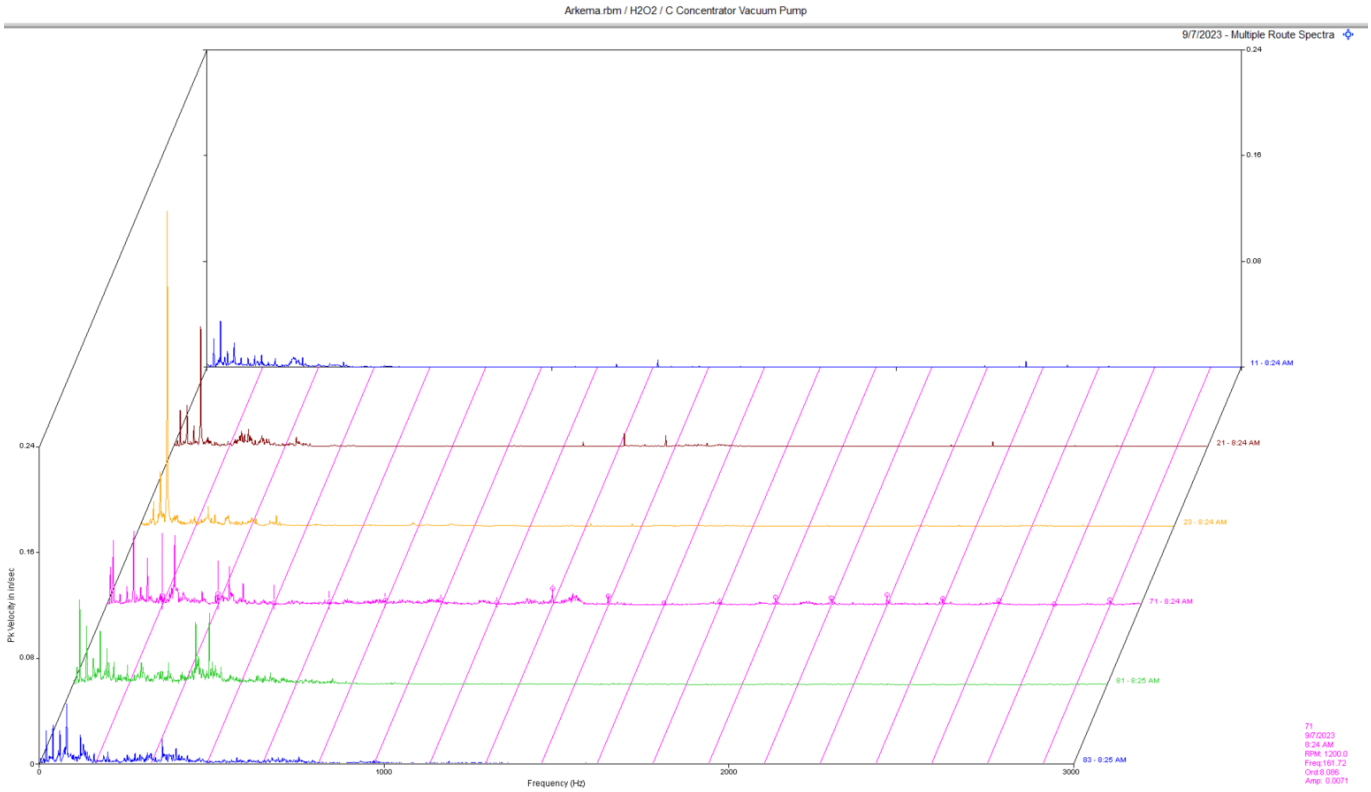
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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

C Concentrator Vacuum Pump CLASS I



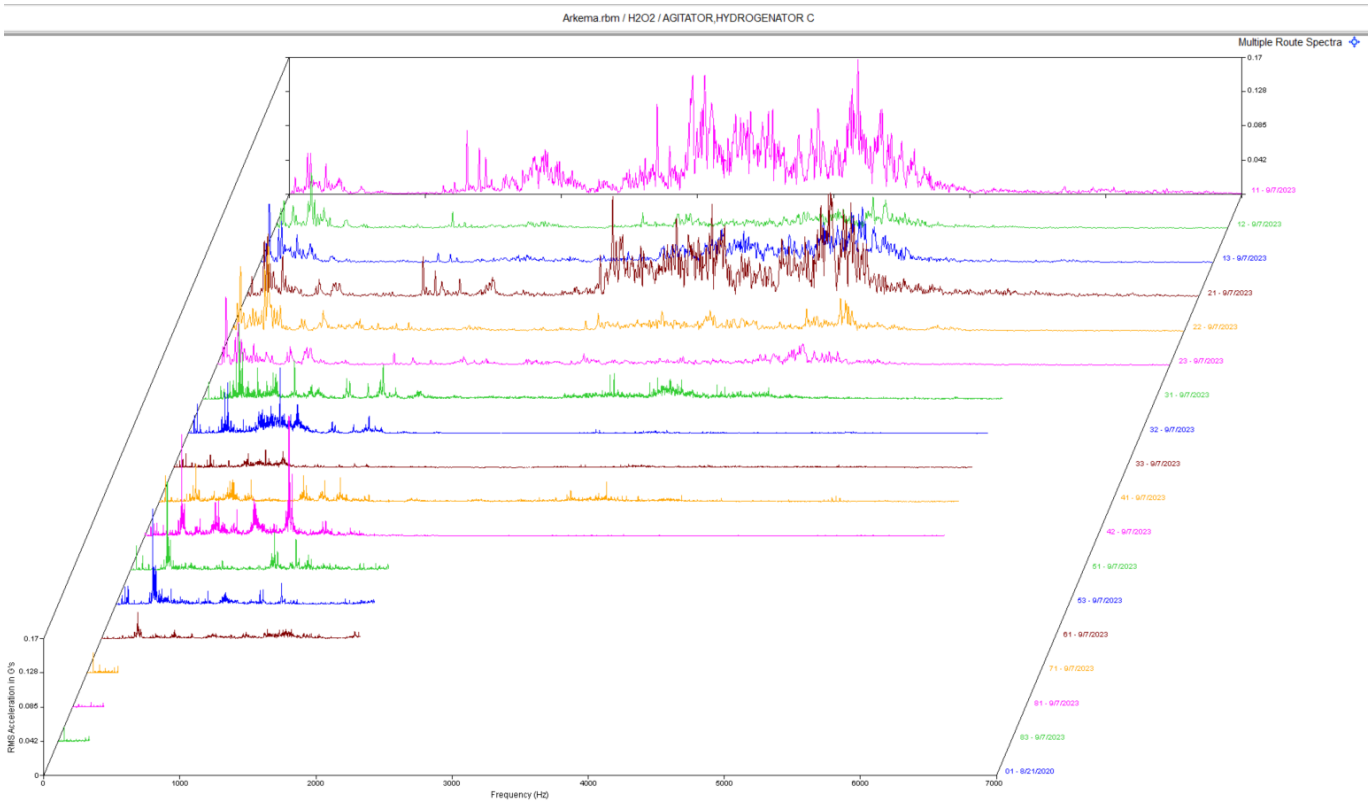
Observation:

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 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



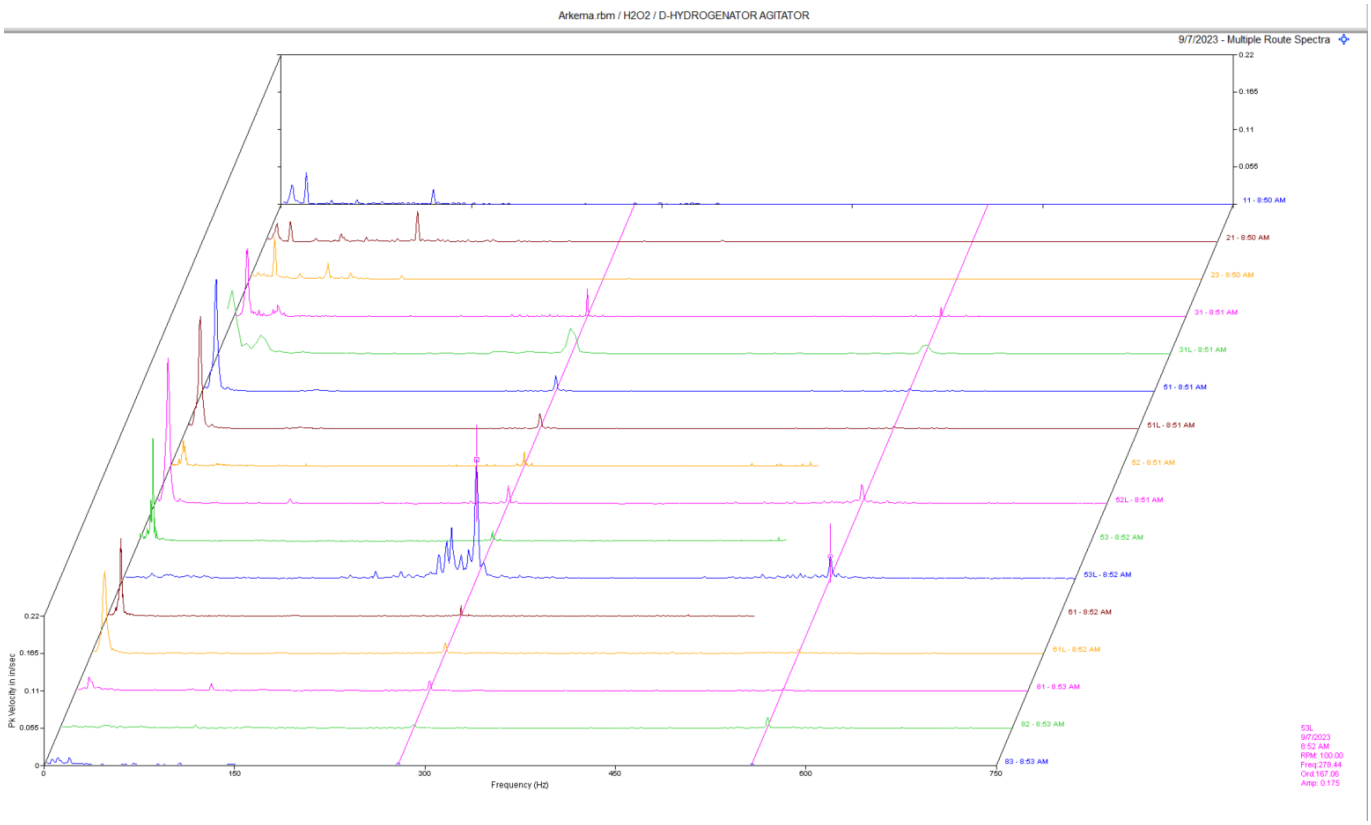
Observation:

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:

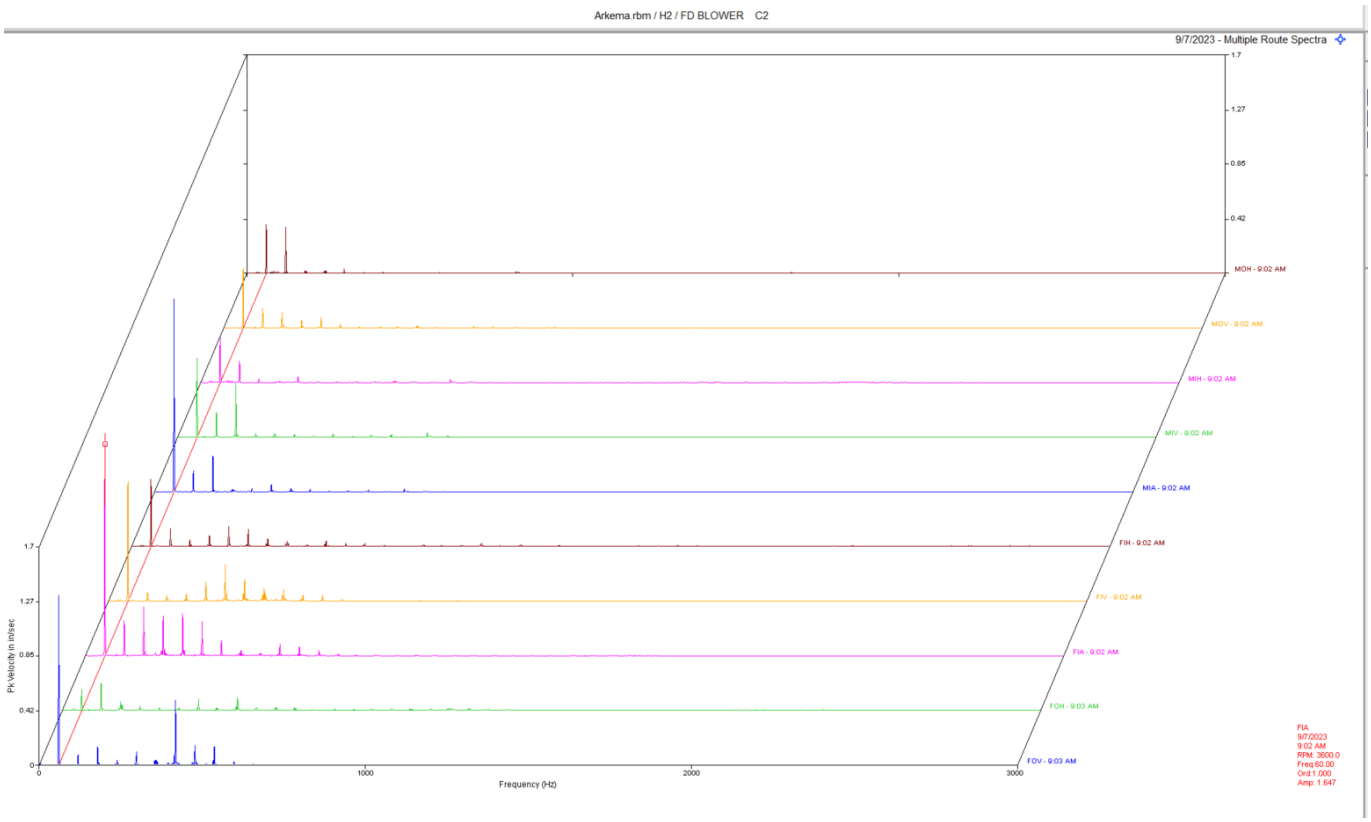
Data above is a multi-point spectra of the motor and gear drive. There is quite a bit of low frequency vibration in the gear drive. Spectral and waveform data shows a dominant low frequency vibration that is likely a harmonic of output speed of the gearbox. Gearbox does appear to have visible torsional movement. 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.

H2O2 Plant WEEKLY

FD Blower **CLASS IV**



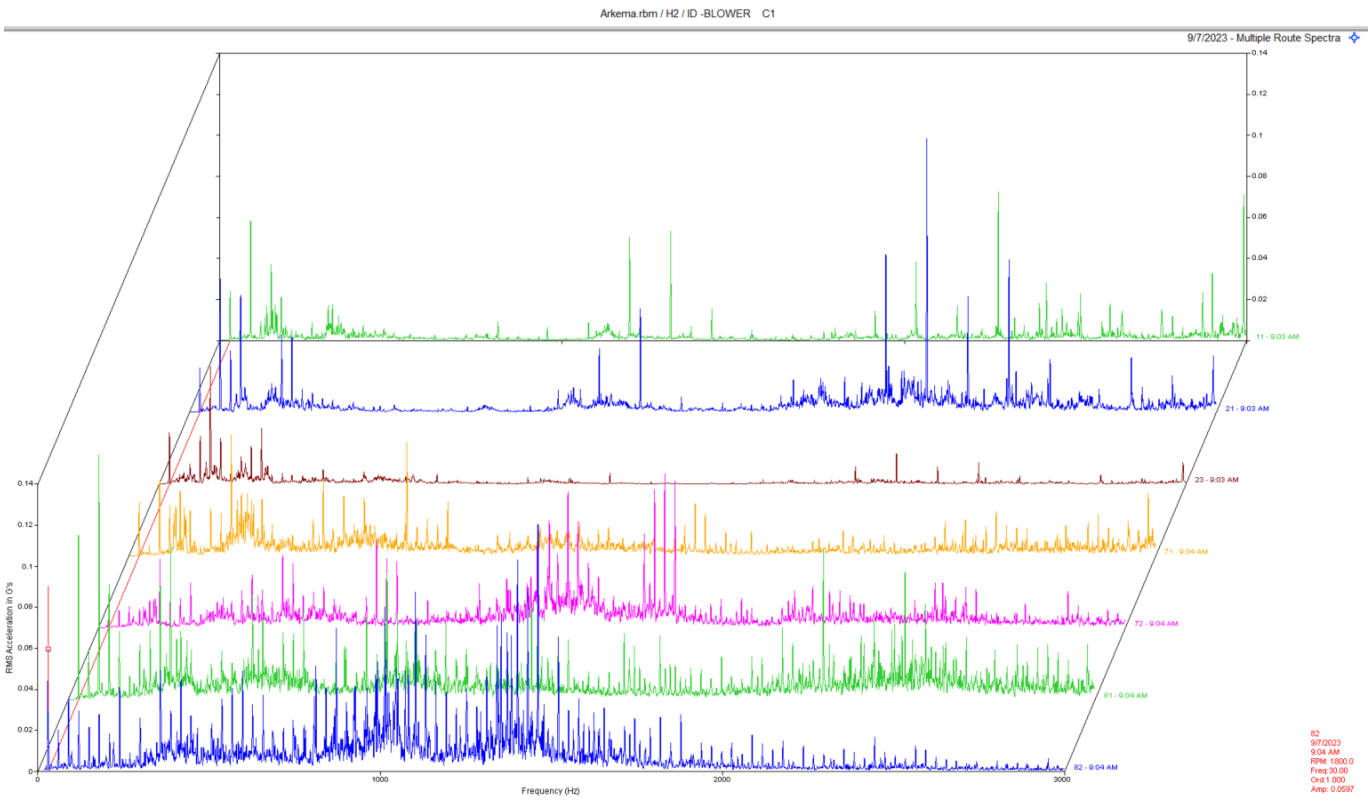
Observation:

Data above shows the highest vibration to be at the motor and fan 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. 2: ARK WK 2

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
P102	- ARKEMA PUMP P102	(01-Sep-23)	
		OVERALL LEVEL	1K-20KHz
MOH		.111 In/Sec	.465 G-s
MOV		.112 In/Sec	.406 G-s
MIH		.088 In/Sec	.663 G-s
MIV		.279 In/Sec	.753 G-s
MIA		.106 In/Sec	.522 G-s
EIA		.329 In/Sec	1.629 G-s
EIH		.218 In/Sec	2.028 G-s
EIV		.263 In/Sec	.902 G-s
EOH		.200 In/Sec	.445 G-s
EOV		.204 In/Sec	1.227 G-s
2130-1old	- C Concentrator Vacuum Pump	(07-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.070 In/Sec	.375 G-s
21		.130 In/Sec	.571 G-s
23		.290 In/Sec	.195 G-s
71		.164 In/Sec	2.273 G-s
81		.183 In/Sec	.443 G-s
83		.120 In/Sec	.254 G-s
7000-01	- AGITATOR,HYDROGENATOR C	(07-Sep-23)	
		OVERALL LEVEL	1-20 KHZ
02		.042 In/Sec	.010 G-s
03		.045 In/Sec	.0087 G-s
11		.081 In/Sec	1.327 G-s
12		.093 In/Sec	.253 G-s
13		.135 In/Sec	.546 G-s
21		.099 In/Sec	1.062 G-s
22		.166 In/Sec	.265 G-s
23		.150 In/Sec	.160 G-s
31		.079 In/Sec	.367 G-s
32		.100 In/Sec	.150 G-s
33		.068 In/Sec	.090 G-s
41		.077 In/Sec	.194 G-s
42		.197 In/Sec	.279 G-s
51		.081 In/Sec	.199 G-s
53		.073 In/Sec	.089 G-s
61		.038 In/Sec	.207 G-s
71		.068 In/Sec	.207 G-s
81		.024 In/Sec	.206 G-s
83		.071 In/Sec	.087 G-s
57	- A/B Concentr Vac Pmp-var RPM	(07-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.043 In/Sec	.382 G-s
12		.061 In/Sec	.078 G-s
21		.054 In/Sec	.595 G-s
23		.052 In/Sec	.076 G-s
71		.146 In/Sec	.487 G-s
81		.254 In/Sec	.867 G-s
83		.082 In/Sec	.360 G-s
2130-1	- FLASH VAP VAC PUMP-var speed	(07-Sep-23)	
		OVERALL LEVEL	1-20 KHz
11		.045 In/Sec	.272 G-s

	12	.039 In/Sec	.047 G-s
	21	.049 In/Sec	.394 G-s
	22	.068 In/Sec	.092 G-s
	23	.066 In/Sec	.120 G-s
	71	.079 In/Sec	.807 G-s
	72	.068 In/Sec	.216 G-s
	81	.075 In/Sec	.930 G-s
	82	.074 In/Sec	.427 G-s
	83	.045 In/Sec	.498 G-s

C-203 - C-203 Comp (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.077 In/Sec	2.851 G-s
12	.032 In/Sec	.907 G-s
21	.118 In/Sec	5.011 G-s
22	.042 In/Sec	1.267 G-s
23	.027 In/Sec	.823 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.083 In/Sec	4.113 G-s
72M	.036 In/Sec	.483 G-s
73M	.084 In/Sec	.911 G-s
81M	.043 In/Sec	7.218 G-s
82M	.038 In/Sec	1.723 G-s
71F	.053 In/Sec	2.142 G-s
72F	.069 In/Sec	1.494 G-s
73F	.061 In/Sec	1.058 G-s
81F	.079 In/Sec	11.58 G-s
82F	.033 In/Sec	2.680 G-s

C-202 - C-202 Comp (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.186 In/Sec	7.748 G-s
12	.150 In/Sec	1.094 G-s
21	.072 In/Sec	1.110 G-s
22	.062 In/Sec	.406 G-s
23	.052 In/Sec	.479 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.055 In/Sec	4.296 G-s
72M	.034 In/Sec	.522 G-s
73M	.074 In/Sec	.660 G-s
81M	.054 In/Sec	7.265 G-s
82M	.037 In/Sec	.867 G-s
71F	.023 In/Sec	6.096 G-s
72F	.063 In/Sec	1.218 G-s
73F	.030 In/Sec	1.193 G-s
81F	.086 In/Sec	24.24 G-s
82F	.044 In/Sec	1.648 G-s

C-201 - C-201 Comp (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.154 In/Sec	4.303 G-s
12	.084 In/Sec	2.286 G-s
21	.105 In/Sec	1.120 G-s
22	.044 In/Sec	.279 G-s
23	.051 In/Sec	.235 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.073 In/Sec	3.897 G-s
72M	.038 In/Sec	.667 G-s
73M	.066 In/Sec	.623 G-s
81M	.047 In/Sec	7.260 G-s
82M	.027 In/Sec	1.315 G-s
71F	.038 In/Sec	3.148 G-s
72F	.052 In/Sec	1.007 G-s
73F	.031 In/Sec	.896 G-s
81F	.055 In/Sec	7.386 G-s
82F	.060 In/Sec	1.955 G-s

new AC - INSTRUMENT AIR COMPRESSOR (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.092 In/Sec	1.059 G-s
12	.107 In/Sec	.424 G-s
13	.049 In/Sec	.135 G-s
21	.080 In/Sec	1.331 G-s
22	.081 In/Sec	.354 G-s
23	.049 In/Sec	.326 G-s
	OVERALL LEVEL	1-20 KHZ
71F	.071 In/Sec	9.057 G-s
72F	.092 In/Sec	1.642 G-s
73F	.094 In/Sec	1.848 G-s
81F	.125 In/Sec	4.695 G-s
82F	.141 In/Sec	1.958 G-s
83F	.137 In/Sec	1.773 G-s
71M	.082 In/Sec	8.448 G-s
72M	.069 In/Sec	2.683 G-s
73M	.106 In/Sec	1.245 G-s
81M	.170 In/Sec	8.814 G-s
82M	.271 In/Sec	2.050 G-s
83M	.198 In/Sec	1.561 G-s

201-08A - COMPRESSOR,NASH A 201-08A (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.050 In/Sec	.107 G-s
12	.055 In/Sec	.094 G-s
13	.098 In/Sec	.081 G-s
21	.051 In/Sec	.081 G-s
22	.048 In/Sec	.080 G-s
23	.153 In/Sec	.119 G-s
71	.157 In/Sec	.722 G-s
72	.168 In/Sec	.083 G-s
73	.123 In/Sec	.131 G-s
81	.153 In/Sec	.255 G-s
82	.174 In/Sec	.043 G-s
83	.116 In/Sec	.073 G-s

202-05 - NASH SEAL LIQUID PUMP-A (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.018 In/Sec	.105 G-s
21	.018 In/Sec	.150 G-s
23	.021 In/Sec	.100 G-s
71	.027 In/Sec	.103 G-s
72	.018 In/Sec	.019 G-s

9002-10 - D-HYDROGENATOR AGITATOR (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.069 In/Sec	.228 G-s
21	.071 In/Sec	.263 G-s
23	.076 In/Sec	.067 G-s
	OVERALL LEVEL	1-20 KHZ
31	.179 In/Sec	.765 G-s
31L	.123 In/Sec	.818 G-s
	OVERALL LEVEL	1-20 KHz
51	.217 In/Sec	.314 G-s
51L	.217 In/Sec	.314 G-s
52	.084 In/Sec	.198 G-s
52L	.278 In/Sec	.428 G-s
53	.226 In/Sec	.130 G-s
53L	.274 In/Sec	.235 G-s
61	.185 In/Sec	.210 G-s
61L	.173 In/Sec	.210 G-s
81	.039 In/Sec	.030 G-s
82	.029 In/Sec	.024 G-s
83	.032 In/Sec	.0097 G-s

9003-01 - D-HYDRO PRIMARY FILT FD PUMP (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.025 In/Sec	.372 G-s
21	.028 In/Sec	.905 G-s

	23	.030 In/Sec	.178 G-s
	71	.082 In/Sec	.299 G-s
	72	.092 In/Sec	.196 G-s

9001-01 - D-HYDRO SECOND. FILT FD PUMP (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	.319 G-s
21	.040 In/Sec	.408 G-s
23	.031 In/Sec	.137 G-s
71	.076 In/Sec	.352 G-s
72	.099 In/Sec	.115 G-s

192-03 - Two Stage Water Pump A-WEST (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.051 In/Sec	.671 G-s
21	.057 In/Sec	.778 G-s
23	.060 In/Sec	.318 G-s
71	.130 In/Sec	.973 G-s
72	.077 In/Sec	.304 G-s

191-07 - M MIX BED WATER PUMP 191-07 (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.084 In/Sec	.446 G-s
21	.064 In/Sec	.538 G-s
23	.088 In/Sec	.126 G-s
71	.256 In/Sec	.405 G-s
72	.237 In/Sec	.163 G-s

Station: HYDROGEN
Route No. 2: H2 WEEKLY

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD

C2 - FD BLOWER C2 (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
MOH	.571 In/Sec	1.264 G-s
MOV	.565 In/Sec	.380 G-s
MIH	.428 In/Sec	1.126 G-s
MIV	.816 In/Sec	.274 G-s
MIA	1.655 In/Sec	.207 G-s
FIH	.658 In/Sec	2.578 G-s
FIV	1.105 In/Sec	.616 G-s
FIA	1.937 In/Sec	.710 G-s
FOH	.378 In/Sec	2.991 G-s
FOV	1.559 In/Sec	.531 G-s

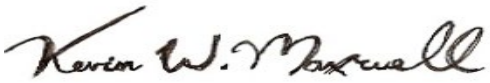
C1 - ID -BLOWER C1 (07-Sep-23)

	OVERALL LEVEL	1-20 KHz
11	.103 In/Sec	.384 G-s
21	.109 In/Sec	.433 G-s
23	.095 In/Sec	.081 G-s
71	.108 In/Sec	.793 G-s
72	.059 In/Sec	.458 G-s
81	.278 In/Sec	1.352 G-s
82	.195 In/Sec	.572 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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