HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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January 3, 2024

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Arkema
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The following is a summary of findings from the December 2023 WEEK 3 vibration survey at the H2O2 Plant that was performed on December 20, 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.

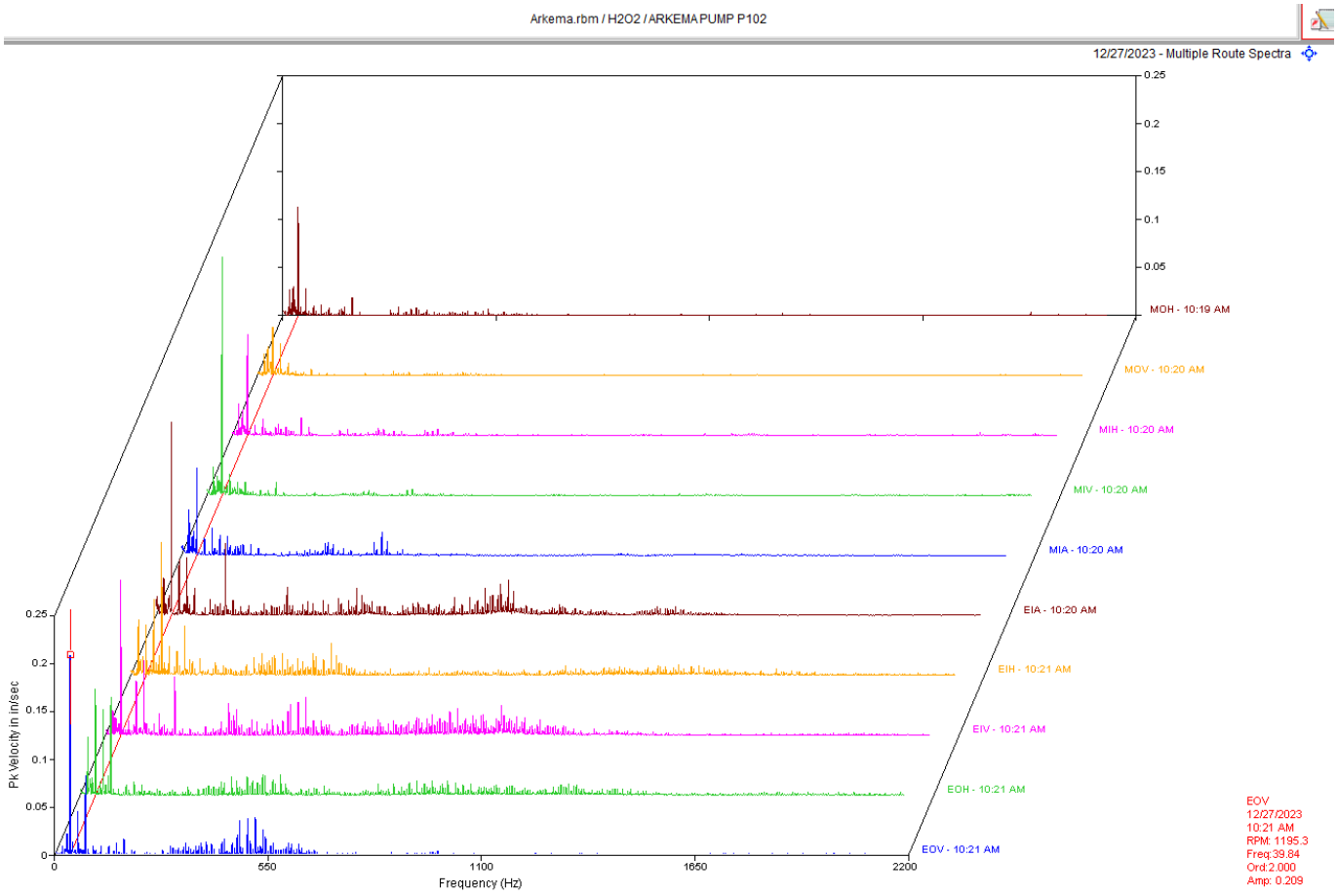
CLASS III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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



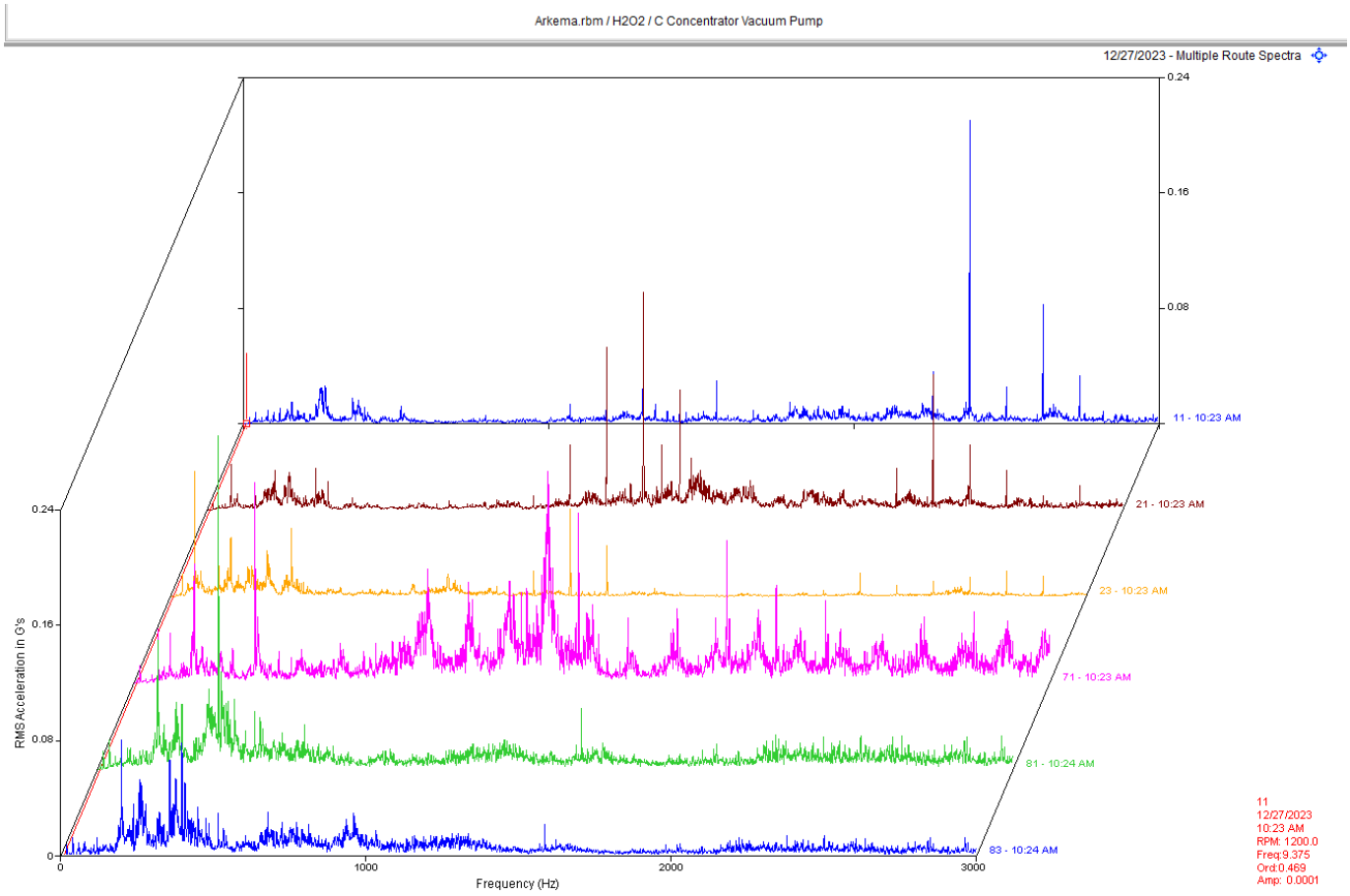
Observation:

Data above is a multipoint spectral waterfall. Pump data shows a 2 x rpm peak with multiple pump 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



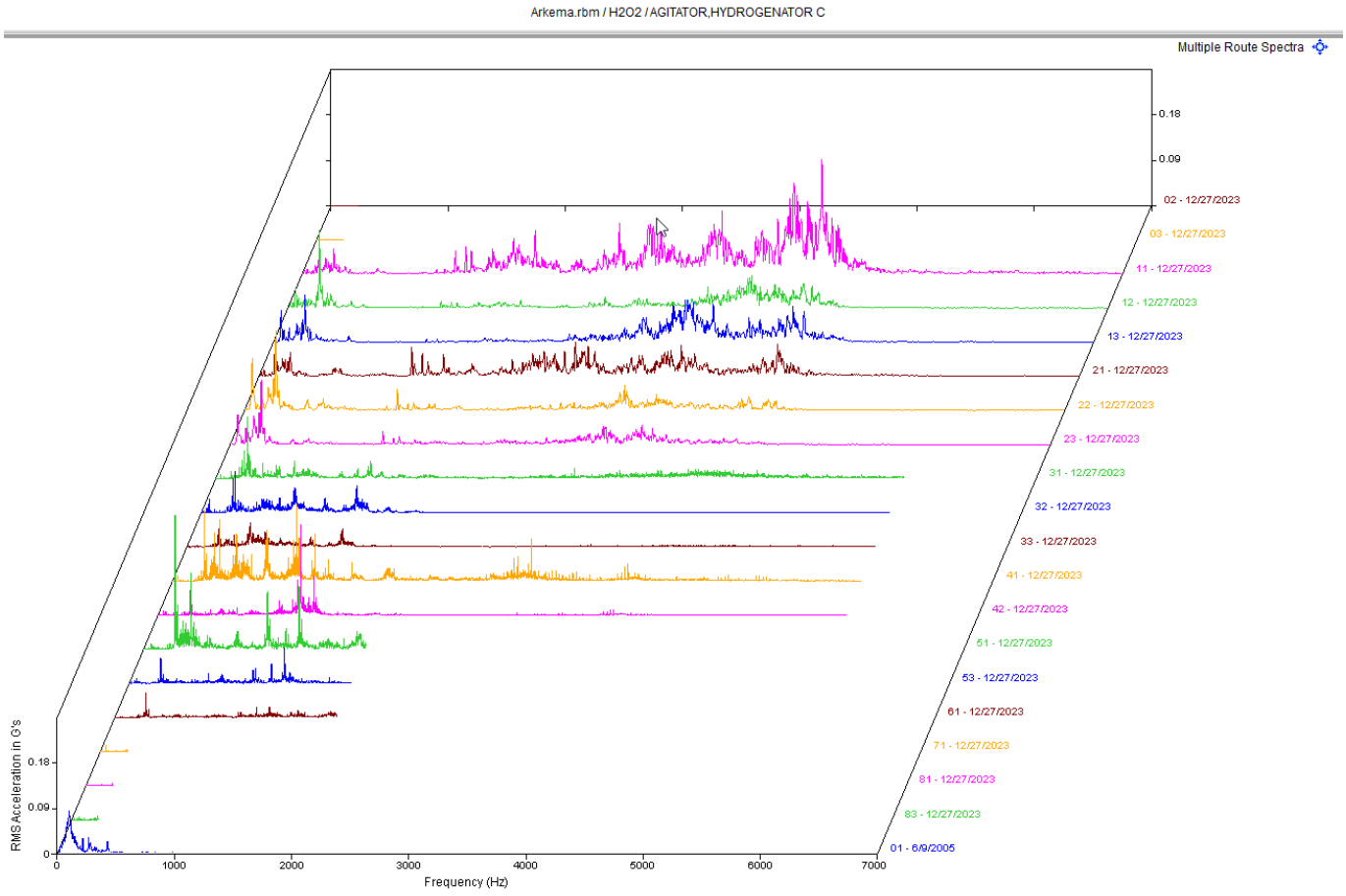
Observation:

Data above is the multi-point spectra of the motor and pump. Pump drive end horizontal shows some 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



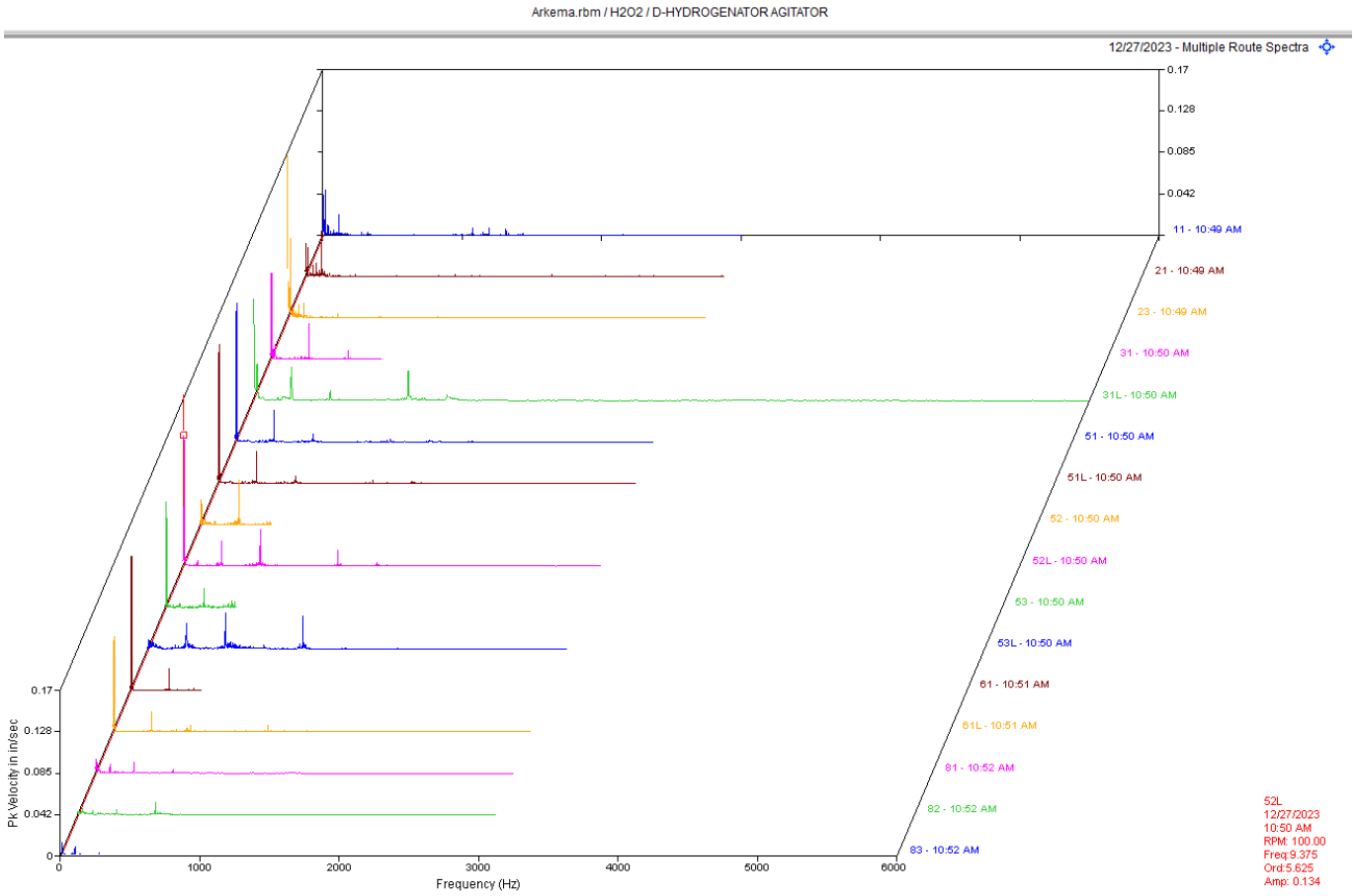
Observation:

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

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.

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	(27-Dec-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.138 In/Sec	.470 G-s
MOV	.086 In/Sec	.323 G-s
MIH	.130 In/Sec	.729 G-s
MIV	.261 In/Sec	.606 G-s
MIA	.142 In/Sec	.353 G-s
EIA	.299 In/Sec	1.102 G-s
EIH	.246 In/Sec	1.852 G-s
EIV	.290 In/Sec	1.790 G-s
EOH	.234 In/Sec	2.957 G-s
EOV	.266 In/Sec	1.225 G-s
2130-1old - C Concentrator Vacuum Pump	(27-Dec-23)	
	OVERALL LEVEL	1-20 KHz
11	.057 In/Sec	.411 G-s
21	.072 In/Sec	.623 G-s
23	.135 In/Sec	.240 G-s
71	.134 In/Sec	2.323 G-s
81	.155 In/Sec	.561 G-s
83	.118 In/Sec	.335 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(27-Dec-23)	
	OVERALL LEVEL	1-20 KHZ
02	.053 In/Sec	.042 G-s
03	.039 In/Sec	.012 G-s
11	.066 In/Sec	1.553 G-s
12	.107 In/Sec	.558 G-s
13	.119 In/Sec	.778 G-s
21	.075 In/Sec	.704 G-s
22	.192 In/Sec	.308 G-s
23	.132 In/Sec	.342 G-s
31	.086 In/Sec	.459 G-s
32	.099 In/Sec	.357 G-s
33	.086 In/Sec	.294 G-s
41	.103 In/Sec	.550 G-s
42	.061 In/Sec	.409 G-s
51	.140 In/Sec	.693 G-s
53	.046 In/Sec	.227 G-s
61	.033 In/Sec	.299 G-s
71	.041 In/Sec	.632 G-s
81	.023 In/Sec	.369 G-s
83	.037 In/Sec	.279 G-s
57 - A/B Concentr Vac Pmp-var RPM	(27-Dec-23)	
	OVERALL LEVEL	1-20 KHz
11	.042 In/Sec	.282 G-s
12	.038 In/Sec	.137 G-s
21	.041 In/Sec	.336 G-s

	23	.039 In/Sec	.127 G-s
	71	.076 In/Sec	.559 G-s
	81	.074 In/Sec	.550 G-s
	83	.054 In/Sec	.402 G-s

2130-1 - FLASH VAP VAC PUMP-var speed (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.039 In/Sec	.624 G-s
12	.040 In/Sec	.672 G-s
21	.044 In/Sec	1.559 G-s
22	.048 In/Sec	.580 G-s
23	.046 In/Sec	.683 G-s
71	.080 In/Sec	.899 G-s
72	.092 In/Sec	1.289 G-s
81	.079 In/Sec	1.208 G-s
82	.083 In/Sec	.701 G-s
83	.052 In/Sec	.335 G-s

C-203 - C-203 Comp (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.073 In/Sec	3.163 G-s
12	.034 In/Sec	1.162 G-s
21	.045 In/Sec	1.725 G-s
22	.025 In/Sec	.634 G-s
23	.025 In/Sec	.627 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.090 In/Sec	4.414 G-s
72M	.054 In/Sec	1.611 G-s
73M	.062 In/Sec	1.233 G-s
81M	.048 In/Sec	7.357 G-s
82M	.045 In/Sec	1.139 G-s
71F	.048 In/Sec	8.420 G-s
72F	.062 In/Sec	1.193 G-s
73F	.036 In/Sec	1.728 G-s
81F	.045 In/Sec	5.326 G-s
82F	.044 In/Sec	1.465 G-s

C-202 - C-202 Comp (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.245 In/Sec	9.066 G-s
12	.164 In/Sec	2.593 G-s
21	.081 In/Sec	1.332 G-s
22	.052 In/Sec	.477 G-s
23	.053 In/Sec	.328 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.070 In/Sec	3.274 G-s
72M	.059 In/Sec	.978 G-s
73M	.093 In/Sec	1.024 G-s
81M	.050 In/Sec	7.534 G-s
82M	.061 In/Sec	1.320 G-s
71F	.037 In/Sec	4.192 G-s
72F	.063 In/Sec	1.095 G-s
73F	.050 In/Sec	1.211 G-s
81F	.042 In/Sec	4.930 G-s
82F	.057 In/Sec	2.307 G-s

C-201 - C-201 Comp (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.134 In/Sec	4.055 G-s
12	.060 In/Sec	.964 G-s
21	.114 In/Sec	1.471 G-s
22	.038 In/Sec	.391 G-s
23	.061 In/Sec	.249 G-s
	OVERALL LEVEL	1-20 KHZ
71M	.086 In/Sec	5.448 G-s
72M	.053 In/Sec	1.235 G-s
73M	.087 In/Sec	1.732 G-s
81M	.050 In/Sec	9.530 G-s
82M	.040 In/Sec	1.299 G-s
71F	.036 In/Sec	7.666 G-s

	72F	.077 In/Sec	2.578 G-s
	73F	.043 In/Sec	1.403 G-s
	81F	.048 In/Sec	8.004 G-s
	82F	.077 In/Sec	1.342 G-s

new AC - INSTRUMENT AIR COMPRESSOR (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.103 In/Sec	1.218 G-s
12	.098 In/Sec	.510 G-s
13	.061 In/Sec	.351 G-s
21	.082 In/Sec	1.845 G-s
22	.074 In/Sec	.591 G-s
23	.033 In/Sec	.399 G-s
	OVERALL LEVEL	1-20 KHZ
71F	.162 In/Sec	8.731 G-s
72F	.077 In/Sec	2.207 G-s
73F	.137 In/Sec	1.754 G-s
81F	.136 In/Sec	9.560 G-s
82F	.332 In/Sec	2.357 G-s
83F	.220 In/Sec	2.342 G-s
71M	.118 In/Sec	9.668 G-s
72M	.121 In/Sec	3.222 G-s
73M	.094 In/Sec	2.931 G-s
81M	.121 In/Sec	4.371 G-s
82M	.186 In/Sec	1.587 G-s
83M	.274 In/Sec	1.995 G-s

201-08A - COMPRESSOR,NASH A 201-08A (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.054 In/Sec	.171 G-s
12	.055 In/Sec	.118 G-s
13	.107 In/Sec	.296 G-s
21	.054 In/Sec	.316 G-s
22	.039 In/Sec	.433 G-s
23	.041 In/Sec	.306 G-s
71	.139 In/Sec	.498 G-s
72	.102 In/Sec	.165 G-s
73	.196 In/Sec	.116 G-s
81	.114 In/Sec	.233 G-s
82	.179 In/Sec	.145 G-s
83	.161 In/Sec	.070 G-s

9002-10 - D-HYDROGENATOR AGITATOR (27-Dec-23)

	OVERALL LEVEL	1-20 KHz
11	.076 In/Sec	.390 G-s
21	.078 In/Sec	.260 G-s
23	.185 In/Sec	.145 G-s
	OVERALL LEVEL	1-20 KHZ
31	.164 In/Sec	.663 G-s
31L	.130 In/Sec	.824 G-s
	OVERALL LEVEL	1-20 KHz
51	.206 In/Sec	.288 G-s
51L	.206 In/Sec	.288 G-s
52	.081 In/Sec	.178 G-s
52L	.213 In/Sec	.440 G-s
53	.214 In/Sec	.076 G-s
53L	.089 In/Sec	.607 G-s
61	.239 In/Sec	.287 G-s
61L	.147 In/Sec	.287 G-s
81	.037 In/Sec	.072 G-s
82	.027 In/Sec	.011 G-s
83	.033 In/Sec	.012 G-s

NTC-SF - N CT-SOUTH FAN, N TWR (20-Dec-23)

	OVERALL LEVEL	1-20 KHz
1	.216 In/Sec	.687 G-s
2	.198 In/Sec	.744 G-s
3	.126 In/Sec	.759 G-s
	OVERALL LEVEL	1-20 KHZ
4	.210 In/Sec	.291 G-s

	5	.0032 In/Sec	.0010 G-s
	6	.213 In/Sec	.472 G-s
NCT - NF	- N CT -NORTH FAN, N TWR		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	7	.115 In/Sec	.422 G-s
	8	.117 In/Sec	.270 G-s
	9	.103 In/Sec	.264 G-s
		OVERALL LEVEL	1-20 KHZ
	10	.172 In/Sec	.148 G-s
	11	.105 In/Sec	.202 G-s
	12	.159 In/Sec	.195 G-s
530-01	- PUMP,N.COOLING TWR,NORTH		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.195 In/Sec	1.599 G-s
	12	.177 In/Sec	.578 G-s
530-02	- PUMP,N.COOLING TWR,MIDDLE		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.078 In/Sec	1.203 G-s
	12	.171 In/Sec	1.431 G-s
548-7	- IRON-FREE H2O BOOSTER PUMP		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.029 In/Sec	.684 G-s
	21	.031 In/Sec	.613 G-s
	23	.046 In/Sec	1.143 G-s
	71	.034 In/Sec	.122 G-s
	72	.026 In/Sec	.223 G-s
STC-NF	- S CT - NORTH FAN, S TWR		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	1	.239 In/Sec	.356 G-s
	2	.166 In/Sec	.179 G-s
	3	14.10 In/Sec	.066 G-s
		OVERALL LEVEL	1-20 KHZ
	4	.132 In/Sec	.376 G-s
	5	.131 In/Sec	.426 G-s
STC-SF	- S CT - SOUTH FAN, S TWR		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	1	.213 In/Sec	.375 G-s
	2	.329 In/Sec	.214 G-s
	3	.160 In/Sec	.094 G-s
		OVERALL LEVEL	1-20 KHZ
	4	.121 In/Sec	.450 G-s
	5	.117 In/Sec	.497 G-s
	6	.255 In/Sec	.605 G-s
SCT-1	- SOUTH CT PUMP - EAST		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.113 In/Sec	2.953 G-s
	21	.162 In/Sec	4.305 G-s
	23	.061 In/Sec	1.075 G-s
	71	.317 In/Sec	1.115 G-s
	72	.072 In/Sec	1.159 G-s
SCT-2	- SOUTH CT PUMP - MID		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.061 In/Sec	1.385 G-s
	21	.055 In/Sec	1.328 G-s
	23	.113 In/Sec	2.434 G-s
	71	.089 In/Sec	.765 G-s
	72	.050 In/Sec	1.467 G-s
SCT-3	- SOUTH CT PUMP - WEST		(20-Dec-23)
		OVERALL LEVEL	1-20 KHz
	11	.066 In/Sec	1.845 G-s
	21	.055 In/Sec	.480 G-s

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            23                      .086 In/Sec       .795 G-s
            71                      .137 In/Sec      1.656 G-s
            72                      .119 In/Sec      1.461 G-s

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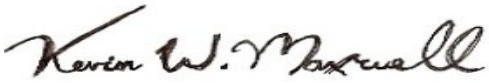
As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

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