HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

August 30, 2021

Arkema

Subject: August week 4 service report

Critical equipment and monthly equipment with issues are discussed in this report.

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

Hi-Speed Industrial Service tests and inspects industrial machinery and equipment and makes recommendations concerning maintenance and repairs based on its experience in the field of industrial repair and maintenance. The information contained herein is provided as an opinion only, not as a guaranty or warranty of the matters discussed herein.

This completes our assessment of your equipment for this survey. Thank you for your business and don't hesitate to call if you have any comments or questions.

Sincerely,

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H2O2 Weekly Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1
The motor has the highest vibration amplitude of about 0.21”/second velocity peak overall in the outboard axial measurement. Vibration still consists of multiple low amplitude shaft speed harmonics with a dominant 4x RPM component we suspect is impeller pass. **Rated a Class I Defect.**

Agitator, Hydrogenator C 7001-01
Data shows all vibrations are below 0.1”/second velocity peak overall. No immediate concern.

A/B Concentrator Vacuum Pump 57
The unit vibration overall is 0.37”/sec peak velocity for the outboard pump bearing and is dominated by a 16 order vibration which we believe to be vane pass. We will continue to watch for changes. **Rated a Class I Defect.**

Flash Vacuum Pump 2130-1
Data shows all vibrations are under 0.1”/second velocity peak overall. No issues of note.

Air Compressor C-201
Rotor bar vibrations are low for this motor’s history. The trend clearly shows that the vibrations vary considerably over time. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading. There are still blower case vibrations around 2.5-3 KHz with a wide noise floor. Overall acceleration is 6 g’s RMS at 1 point. Synchronous and non-synchronous harmonic vibration peaks are evident in the data. All 3 compressors have the same non-synchronous peaks but vary in amplitude. We will continue to monitor this unit closely for changes. **Rated a Class I Defect.**

Air Compressor C-202
Rotor bar vibrations are low for this motor’s history. The trend clearly shows that the vibrations vary considerably over time. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading. There are still blower case vibrations around 2.5-3 KHz with a wide noise floor. Overall acceleration is 8 g’s RMS at 1 point. **Rated a Class I Defect**.

Air Compressor C-203
Rotor bar vibrations are normal for this motor’s history and could indicate higher loading The trend clearly shows that the vibrations vary considerably over time. We still believe these motors have possible weak rotor bar end connections that cause the vibrations to fluctuate higher due to loading. There are still blower case vibrations around 2.5-3 KHz with a wide noise floor. Overall acceleration is 3.6 g’s RMS at 1 point. **Rated a Class I Defect**.

Instrument Air Compressor
The male and female shaft vibrations still seem to show harmonics as well as a beat vibration occasionally. They continue to vary over time. Both shafts have between 7 and 13 g's RMS overall in the data. The dominant vibration appears to be a harmonic at near 2490 Hz. We are still watching this unit closely and will be going forward. **Rated a Class II Defect.**

Air Compressor NASH A 201-08A
Vibrations have dropped to 0.19"/sec velocity peak for the outboard vertical. The vibration spectrum is still dominated by a 20-order vibration, which is thought to be vane pass. **Rated a Class I Defect.**

D Hydrogenator Agitator 9002
Highest overall vibration is at 0.29"/sec velocity peak for the gearbox output top horizontal. 2 dominant vibrations are sub-synchronous to motor speed at about 9 Hz and a 10.5 orders. peak and harmonic. There appears to be a resonance, and the amplitude changes over time, but does not seem to be periodic. The others are most likely the number of pinion teeth (14 teeth and the input gear mesh) and the first harmonic of gear mesh. Ensure all fasteners are at proper torque values and inspect support structures for any signs of stress cracks, broken welds, or metal fatigue. **Rated a Class I Defect now.**

Centac Compressor
The unit was not in operation during the survey.

H2O2 Monthly Route Equipment

191-07 Middle Mix Bed Water Pump
Data continues to show a dominant 5x RPM vibration in the pump. We suspect wear in the pump impeller, or a process or flow issue. **Rated a Class I Defect.**

North Cooling Tower South Fan
The motor is shaft speed vibration is being modulated by another vibration which is causing a beat vibration as they come in and out of phase. Inspect the fasteners, structure and coupling as time allows. **Rated a Class I Defect.**

H2 Monthly Route Equipment

FD Fan

Most vibrations in the unit have been climbing since last August at unit shaft speed. The inboard end if the motor is dominant at 0.415"/second velocity peak. Axial motor data shows a few harmonics as well as the fan bearings radial measurements. At the next opportunity, inspect the unit fasteners and structure, coupling and alignment, and fan wheel for issues at the. Inspect the fan bearings and purge out old grease. Purge coupling grease if so equipped. Trim balance the fan after cleaning as needed. **Rated a Class II Defect.**

ID Fan

Harmonic vibrations are up slightly in the fan bearings. They were also generating some noise. Inspect and purge the fan bearings at the next opportunity. Check all fasteners, the coupling and alignment. Purge coupling grease if so equipped. **Rated a Class II Defect.**

East Cooling Tower Pump

Vibration in the pump has increased at shaft speed to 0.44"/second peak velocity. Check all fasteners, the coupling and alignment as time allows. **Rated a Class II Defect.**

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 6: ARKEMA WK4
Report Date: 30-Aug-21 13:04

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
2130-1old - C Concentrator Vacuum Pump	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHz	
11	.065 In/Sec	.348 G-s	1200.0 RPM
21	.064 In/Sec	.395 G-s	
23	.207 In/Sec	.158 G-s	
71	.133 In/Sec	.740 G-s	
81	.158 In/Sec	.673 G-s	
83	.091 In/Sec	1.536 G-s	
7000-01 - AGITATOR,HYDROGENATOR C	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHZ	
02	.050 In/Sec	.0023 G-s	45.00 RPM
03	.045 In/Sec	.015 G-s	
11	.073 In/Sec	.711 G-s	1400.0 RPM
12	.066 In/Sec	.657 G-s	
13	.067 In/Sec	.259 G-s	
21	.078 In/Sec	.242 G-s	

	22	.084 In/Sec	.211 G-s	
	23	.069 In/Sec	.822 G-s	
	31	.073 In/Sec	.423 G-s	
	32	.068 In/Sec	.482 G-s	
	33	.041 In/Sec	.227 G-s	
	41	.075 In/Sec	.498 G-s	
	42	.066 In/Sec	.606 G-s	
	51	.072 In/Sec	.306 G-s	375.0 RPM
	53	.078 In/Sec	.204 G-s	
	61	.036 In/Sec	.252 G-s	
	71	.058 In/Sec	.479 G-s	45.00 RPM
	81	.023 In/Sec	.158 G-s	
	83	.052 In/Sec	.197 G-s	

57 - A/B Concentr Vac Pmp-var RPM (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.076 In/Sec	.144 G-s	900.0 RPM
	12	.076 In/Sec	.251 G-s	
	21	.077 In/Sec	.255 G-s	
	23	.075 In/Sec	.186 G-s	
	71	.130 In/Sec	1.066 G-s	
	81	.370 In/Sec	.747 G-s	
	83	.047 In/Sec	.983 G-s	

2130-1 - FLASH VAP VAC PUMP-var speed (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.043 In/Sec	.089 G-s	1200.0 RPM
	12	.037 In/Sec	.300 G-s	
	21	.041 In/Sec	.408 G-s	
	22	.037 In/Sec	.551 G-s	
	23	.050 In/Sec	.371 G-s	
	71	.064 In/Sec	.264 G-s	
	72	.073 In/Sec	.590 G-s	
	81	.082 In/Sec	.390 G-s	
	82	.073 In/Sec	.699 G-s	
	83	.039 In/Sec	.686 G-s	

C-203 - C-203 Comp (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.034 In/Sec	1.297 G-s	3588.0 RPM
	12	.084 In/Sec	3.032 G-s	
	21	.078 In/Sec	3.248 G-s	
	22	.064 In/Sec	2.337 G-s	
	23	.025 In/Sec	.900 G-s	
		OVERALL LEVEL	1-20 KHZ	
	71M	.029 In/Sec	.781 G-s	
	72M	.042 In/Sec	1.542 G-s	
	73M	.058 In/Sec	3.098 G-s	
	81M	.056 In/Sec	2.693 G-s	
	82M	.057 In/Sec	3.633 G-s	
	71F	.038 In/Sec	3.657 G-s	
	72F	.048 In/Sec	1.341 G-s	
	73F	.083 In/Sec	3.467 G-s	
	81F	.053 In/Sec	3.412 G-s	
	82F	.042 In/Sec	1.672 G-s	

C-202 - C-202 Comp (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.066 In/Sec	.925 G-s	3588.0 RPM
	12	.126 In/Sec	.140 G-s	
	21	.064 In/Sec	.664 G-s	
	22	.089 In/Sec	.672 G-s	
	23	.085 In/Sec	.196 G-s	
		OVERALL LEVEL	1-20 KHZ	
	71M	.033 In/Sec	4.453 G-s	
	72M	.048 In/Sec	1.715 G-s	
	73M	.065 In/Sec	2.726 G-s	
	81M	.033 In/Sec	3.374 G-s	
	82M	.047 In/Sec	3.264 G-s	
	71F	.028 In/Sec	8.108 G-s	
	72F	.056 In/Sec	1.446 G-s	
	73F	.076 In/Sec	2.996 G-s	
	81F	.037 In/Sec	1.078 G-s	
	82F	.045 In/Sec	1.275 G-s	

C-201 - C-201 Comp (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.100 In/Sec	.608 G-s	3588.0 RPM
	12	.073 In/Sec	.731 G-s	
	21	.082 In/Sec	.392 G-s	
	22	.047 In/Sec	.730 G-s	
	23	.068 In/Sec	1.013 G-s	
		OVERALL LEVEL	1-20 KHZ	
	71M	.044 In/Sec	2.298 G-s	
	72M	.044 In/Sec	2.888 G-s	
	73M	.061 In/Sec	1.523 G-s	
	81M	.061 In/Sec	6.836 G-s	
	82M	.048 In/Sec	2.337 G-s	
	71F	.060 In/Sec	2.494 G-s	
	72F	.050 In/Sec	2.678 G-s	
	73F	.055 In/Sec	2.227 G-s	
	81F	.050 In/Sec	2.105 G-s	
	82F	.058 In/Sec	1.843 G-s	

new AC - INSTRUMENT AIR COMPRESSOR (30-Aug-21)

		OVERALL LEVEL	1-20 KHz	
	11	.121 In/Sec	.825 G-s	1780.0 RPM
	12	.097 In/Sec	.679 G-s	
	13	.059 In/Sec	.434 G-s	
	21	.142 In/Sec	1.558 G-s	
	22	.074 In/Sec	.868 G-s	
	23	.049 In/Sec	.414 G-s	
		OVERALL LEVEL	1-20 KHZ	
	71M	.178 In/Sec	6.563 G-s	
	72M	.154 In/Sec	3.345 G-s	
	73M	.132 In/Sec	2.129 G-s	
	81M	.135 In/Sec	3.019 G-s	
	82M	.318 In/Sec	8.566 G-s	
	83M	.192 In/Sec	4.952 G-s	
	71F	.117 In/Sec	7.788 G-s	
	72F	.128 In/Sec	4.174 G-s	
	73F	.282 In/Sec	2.483 G-s	
	81F	.315 In/Sec	11.28 G-s	
	82F	.311 In/Sec	13.15 G-s	

83F	.143 In/Sec	3.039 G-s		

201-08A - COMPRESSOR,NASH A 201-08A (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.047 In/Sec	.073 G-s	506.3 RPM
12	.048 In/Sec	.166 G-s	
13	.103 In/Sec	.063 G-s	
21	.052 In/Sec	.073 G-s	
22	.053 In/Sec	.070 G-s	
23	.076 In/Sec	.069 G-s	
71	.109 In/Sec	.881 G-s	
72	.174 In/Sec	.978 G-s	
73	.110 In/Sec	.142 G-s	
81	.122 In/Sec	.224 G-s	
82	.194 In/Sec	.212 G-s	
83	.111 In/Sec	.147 G-s	

9002-10 - D-HYDROGENATOR AGITATOR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.089 In/Sec	.055 G-s	1185.0 RPM
21	.071 In/Sec	.076 G-s	
23	.047 In/Sec	.044 G-s	
	OVERALL LEVEL	1-20 KHZ	
31	.241 In/Sec	.693 G-s	
31L	.166 In/Sec	.663 G-s	
	OVERALL LEVEL	1-20 KHz	
51	.201 In/Sec	.246 G-s	
51L	.246 In/Sec	.265 G-s	100.0 RPM
52	.252 In/Sec	.266 G-s	
52L	.286 In/Sec	.253 G-s	
53	.085 In/Sec	.442 G-s	
53L	.031 In/Sec	.419 G-s	
61	.161 In/Sec	.116 G-s	
61L	.158 In/Sec	.118 G-s	
81	.032 In/Sec	.034 G-s	
82	.031 In/Sec	.041 G-s	
83	.025 In/Sec	.124 G-s	

9003-01 - D-HYDRO PRIMARY FILT FD PUMP (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.050 In/Sec	.109 G-s	1800.0 RPM
21	.033 In/Sec	.321 G-s	
23	.041 In/Sec	.249 G-s	
71	.095 In/Sec	.229 G-s	
72	.098 In/Sec	.198 G-s	

9001-01 - D-HYDRO SECOND. FILT FD PUMP (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.053 In/Sec	.335 G-s	1800.0 RPM
21	.045 In/Sec	.536 G-s	
23	.030 In/Sec	.161 G-s	
71	.077 In/Sec	.243 G-s	
72	.058 In/Sec	.266 G-s	

192-03 - Two Stage Water Pump A-WEST (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.080 In/Sec	.141 G-s	1765.0 RPM

21	.073 In/Sec	.304 G-s	
23	.053 In/Sec	.277 G-s	
71	.117 In/Sec	.512 G-s	
72	.057 In/Sec	.512 G-s	

191-07 - M MIX BED WATER PUMP 191-07 (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.108 In/Sec	.470 G-s	3600.0 RPM
21	.066 In/Sec	1.047 G-s	
23	.110 In/Sec	.537 G-s	
71	.348 In/Sec	.246 G-s	
72	.178 In/Sec	.207 G-s	

NTC-SF - N CT-SOUTH FAN, N TWR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
1	.367 In/Sec	.531 G-s	1780.0 RPM
2	.194 In/Sec	.415 G-s	
3	.221 In/Sec	.461 G-s	
	OVERALL LEVEL	1-20 KHZ	
4	.222 In/Sec	.423 G-s	
5	.0049 In/Sec	.0012 G-s	
6	.276 In/Sec	.414 G-s	
6L	.303 In/Sec	.386 G-s	

NCT - NF - N CT -NORTH FAN, N TWR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
7	.247 In/Sec	.506 G-s	1780.0 RPM
8	.138 In/Sec	.410 G-s	
9	.136 In/Sec	.334 G-s	
	OVERALL LEVEL	1-20 KHZ	
10	.139 In/Sec	.335 G-s	
11	.136 In/Sec	.299 G-s	
12	.142 In/Sec	.383 G-s	

STC-NF - S CT - NORTH FAN, S TWR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
1	.289 In/Sec	.599 G-s	1780.0 RPM
2	.220 In/Sec	.399 G-s	
3	.259 In/Sec	.160 G-s	
	OVERALL LEVEL	1-20 KHZ	
4	.130 In/Sec	.342 G-s	
5	.135 In/Sec	.472 G-s	

STC-MF - S CT - MID FAN, S TWR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
1	.264 In/Sec	.378 G-s	1780.0 RPM
3	.116 In/Sec	.102 G-s	
	OVERALL LEVEL	1-20 KHZ	
4	.084 In/Sec	.264 G-s	
5	.123 In/Sec	.426 G-s	
6	.090 In/Sec	.493 G-s	

STC-SF - S CT - SOUTH FAN, S TWR (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
1	.193 In/Sec	.377 G-s	1780.0 RPM
2	.254 In/Sec	.212 G-s	
3	.330 In/Sec	.097 G-s	
	OVERALL LEVEL	1-20 KHZ	

4	.173 In/Sec	.495 G-s
5	.104 In/Sec	.544 G-s
6	.221 In/Sec	.640 G-s

Clarification Of Vibration Units:
Acc --> G-s PK
Vel --> In/Sec PK

Abbreviated Last Measurement Summary

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Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: HYDROGEN
Route No. 1: H2 MONTHLY
Report Date: 30-Aug-21 14:40

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
P2B - PUMP MEA CIRC EAST P2B	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHz	
11	.094 In/Sec	1.933 G-s	3585.0 RPM
21	.088 In/Sec	3.067 G-s	
23	.154 In/Sec	1.736 G-s	
71	.186 In/Sec	.958 G-s	
72	.119 In/Sec	1.422 G-s	
P1B - PUMP BFW EAST P1B	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHz	
11	.056 In/Sec	.252 G-s	3600.0 RPM
21	.047 In/Sec	.721 G-s	
23	.041 In/Sec	.103 G-s	
71	.135 In/Sec	.165 G-s	
72	.122 In/Sec	.246 G-s	
81	.072 In/Sec	.213 G-s	
82	.072 In/Sec	.390 G-s	
83	.031 In/Sec	.948 G-s	
C2 - FD BLOWER C2	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHz	
11	.364 In/Sec	.264 G-s	3600.0 RPM
21	.421 In/Sec	.301 G-s	
23	.221 In/Sec	.188 G-s	
71	.267 In/Sec	1.942 G-s	
81	.276 In/Sec	1.686 G-s	
C1 - ID -BLOWER C1	(30-Aug-21)		
	OVERALL LEVEL	1-20 KHz	
11	.131 In/Sec	.404 G-s	1800.0 RPM
21	.142 In/Sec	.302 G-s	
23	.174 In/Sec	.277 G-s	
71	.120 In/Sec	.963 G-s	
72	.081 In/Sec	1.041 G-s	
81	.282 In/Sec	1.261 G-s	
82	.207 In/Sec	1.190 G-s	

CTPE	- EAST COOLING TOWER PUMP		(30-Aug-21)	
		OVERALL LEVEL	1-20 KHz	
11		.198 In/Sec	1.420 G-s	1750.0 RPM
21		.089 In/Sec	.419 G-s	
23		.235 In/Sec	1.129 G-s	
71		.106 In/Sec	.754 G-s	
72		.458 In/Sec	.860 G-s	

CTPW	- WEST COOLING TOWER PUMP		(30-Aug-21)	
		OVERALL LEVEL	1-20 KHz	
11		.097 In/Sec	.518 G-s	1750.0 RPM
21		.097 In/Sec	.522 G-s	
23		.067 In/Sec	.529 G-s	
71		.108 In/Sec	.836 G-s	
72		.091 In/Sec	.906 G-s	

Clarification Of Vibration Units:

Acc	-->	G-s	PK
Vel	-->	In/Sec	PK