

January 3, 2021

Arkema

Subject: December 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.

<u>Class I:</u> Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

<u>Class II:</u> Defect (s) present that may cause problem in long term (2-6 months.). Repair during normal maintenance scheduling. Continue to monitor.

<u>Class III</u>: 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.

<u>Class IV</u>; 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,

David W. Shook Senior Reliability Specialists *Hi-Speed* Industrial Service dshook@gohispeed.com

> 7030 Ryburn Drive Millington, TN 38053 P. 901-873-5300 F. 901-873-5301

H2O2 Weekly Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1

The motor has the highest vibration amplitude of about 0.2"/second velocity peak overall in the inboard axial measurement. Vibration still consists of multiple low amplitude shaft speed harmonics with a dominant 4x RPM peak. **Rated a Class I Defect.**

Agitator, Hydrogenator C 7001-01

Data shows a drop in vibrations in the motor. No actions required.

A/B Concentrator Vacuum Pump 57

The was down during the survey.

Flash Vacuum Pump 2130-1

Data still shows all vibrations are under 0.1"/second velocity peak overall, however there is still elevated acceleration overall in the motor drive end bearing axial. Ensure bearings are lubricated per manufactures recommendations. We will watch for changes. **Rated a Class I Defect.**

Air Compressor C-201

Rotor bar vibrations are normal 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 low noise floor. Synchronous and non-synchronous harmonic vibration peaks are evident in the data. Overall acceleration is 4 g's RMS at 1 point. 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 low noise floor. Synchronous and non-synchronous harmonic vibration peaks are evident in the data. Overall acceleration is 4.6 g's RMS at 1 point. We will continue to monitor this unit closely for changes **Rated a Class I Defect.**

Air Compressor C-203

Rotor bar vibrations are normal 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 low noise floor. Synchronous and non-synchronous harmonic vibration peaks are evident in the data. Overall acceleration is 7 g's RMS at 1 point. We will continue to monitor this unit closely for changes. **Rated a Class I Defect.**

Instrument Air Compressor

The male and female shaft vibrations still seem to show gear mesh and lobe pass harmonics as well as a beat vibration occasionally. They continue to vary over time. Both shafts have between 5 and 8 g's RMS overall acceleration. The dominant vibrations appears to be at near 2500 Hz and are possibly harmonic. We are still watching this unit closely and will be going forward. **Rated a Class I Defect.**

Air Compressor NASH A 201-08A

Vibrations are at 0.14"/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. Non-rated.

D Hydrogenator Agitator 9002

Highest overall vibration is at 0.24"/sec velocity peak for the gearbox output top E/W. Dominant vibrations are at about 10.5 Hx and 14 orders of the input speed. They appear to be a resonant, but the one of them could be a gear mesh. The time waveform shows they are most likely periodically beating (going into and out of phase). Ensure all fasteners are at proper torque values and inspect support structures for any signs of stress cracks, broken welds, or metal fatigue. Perform periodic oil analysis on the gearbox for signs of internal wear. **Rated a Class I Defect.**

H2 Monthly Route Equipment

Middle Cooling Tower Pump

The unit shows an elevated shaft speed vibration in the pump and motor. Inspect the coupling, alignment, and all fasteners. Check for soft foot also. **Rated a Class II Defect.**

FD Blower C2

The fan motor still has an elevated shaft speed vibration as well as a few harmonics. The fan bearings also show a few harmonics. Inspect the motor cooling fan, shaft coupling, alignment, structure, and all fasteners. Perform a lift check on the motor and fan shaft to see if there is excessive movement at the bearings indicating loose journal or housing fits. **Rated a Class II Defect.**

PUMP MEA CIRC EAST P2B

The motor and pump bearing acceleration is still elevated and could indicate early distress in the bearings. Ensure the bearings are lubricated if applicable. **Rated a Class II Defect.**

PUMP BOIL FEED WATER PUMP WEST P1A

The motor axial vibration has been steadily increasing at 1x RPM. This is a good indication of a coupling or alignment issue. Inspect all fasteners and the coupling. Perform a precision alignment. **Rated a Class II Defect.**

Database:Arkema.rbmStation:PEROXIDERoute No.6:ARKEMA WK4Report Date:03-Jan-2208:06

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
2130-1old - C Co	ncentrator Vacuum Pum	p (29-Dec-21)	
	OVERALL LEVEL	1-20 KHz	1000 0 554
11	.069 In/Sec	.391 G-S	1200.0 RPM
21	.068 In/Sec	.505 G-S	
23	.190 IN/Sec	.197 G-S	
71	.15/ IN/Sec	1.082 G-S	
02	.10/ IN/Sec	.037 G-S	
65	.075 11/560	1.365 G-S	
7000-01 - AGIT	ATOR, HYDROGENATOR C	(29-Dec-21)	
	OVERALL LEVEL	1-20 KHZ	
02	.048 In/Sec	.025 G-s	45.00 RPM
03	.045 In/Sec	.029 G-s	
11	.075 In/Sec	.305 G-s	1400.0 RPM
12	.062 In/Sec	.689 G-s	
13	.086 In/Sec	.220 G-s	
21	.092 In/Sec	.354 G-s	
22	.112 In/Sec	.094 G-s	
23	.081 In/Sec	.320 G-s	
31	.073 In/Sec	.363 G-s	
32	.079 In/Sec	.398 G-s	
33	.061 In/Sec	.216 G-s	
41	.068 In/Sec	.458 G-s	
42	.077 In/Sec	.638 G-s	
51	.066 In/Sec	.620 G-s	375.0 RPM
53	.067 In/Sec	.208 G-s	
61	.038 In/Sec	.229 G-s	
71	.072 In/Sec	.180 G-s	45.00 RPM
81	.024 In/Sec	.147 G-s	
83	.045 In/Sec	.187 G-s	
2130-1 - FLAS	H VAP VAC PUMP-var sp	eed (29-Dec-21)	
	OVERALL LEVEL	1-20 KHz	
11	.053 In/Sec	.086 G-s	1200.0 RPM
12	.037 In/Sec	.315 G-s	
21	.039 In/Sec	.970 G-s	
22	.045 In/Sec	.514 G-s	
23	.056 In/Sec	1.193 G-s	
71	.058 In/Sec	.319 G-s	
72	.073 In/Sec	.276 G-s	
81	.076 In/Sec	.471 G-s	
82	.083 In/Sec	.754 G-s	
83	.040 In/Sec	.699 G-s	
C-203 - C-20	3 Comp	(29-Dec-21)	
	-		

	OVERALL LEVEL	1-20 KHz	
11	.092 In/Sec	3.553 G-s	3588.0 RPM
12	.082 In/Sec	3.111 G-s	
21	.045 In/Sec	1.638 G-s	
22	.071 In/Sec	2.195 G-s	
23	.064 In/Sec	2.483 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.040 In/Sec	3.073 G-s	
72M	.044 In/Sec	1.554 G-s	
73M	.055 In/Sec	7.087 G-s	
81M	.045 In/Sec	2.009 G-s	
82M	.057 In/Sec	6.012 G-s	
71F	.037 In/Sec	2.381 G-s	
72F	.049 In/Sec	1.748 G-s	
73F	.080 In/Sec	3.982 G-s	
81F	.052 In/Sec	3.201 G-s	
82F	.039 In/Sec	1.063 G-s	
C-202 - C-2	02 Comp	(29-Dec-21)	
	OVERALL LEVEL	1-20 KHz	
11	.061 In/Sec	.394 G-s	3588.0 RPM
12	.115 In/Sec	.578 G-s	
21	.062 In/Sec	.982 G-s	
22	.085 In/Sec	.432 G-s	
23	.039 In/Sec	.504 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.036 In/Sec	.961 G-s	
72M	.045 In/Sec	1.204 G-s	
73M	.066 In/Sec	4.092 G-s	
81M	.048 In/Sec	3.093 G-s	
82M	.061 In/Sec	4.630 G-s	
71F	.034 In/Sec	2.598 G-s	
72F	.058 In/Sec	1.105 G-s	
735	.04/ In/Sec	2.045 G-s	
811	.041 In/Sec	2.104 G-s	
821	.052 In/Sec	1.4// G-s	
C-201 - C-2	01 Comp	(29-Dec-21)	
	OVERALL LEVEL	1-20 KHz	
11	.158 In/Sec	4.847 G-s	3588.0 RPM
12	.128 In/Sec	4.772 G-s	
21	.108 In/Sec	2.536 G-s	
22	.043 In/Sec	.532 G-s	
23	.057 In/Sec	.680 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.037 In/Sec	1.338 G-s	
72M	.048 In/Sec	3.314 G-s	
73M	.074 In/Sec	1.706 G-s	
81M	.087 In/Sec	4.167 G-s	
82M	.055 In/Sec	3.266 G-s	
71F	.040 In/Sec	2.495 G-s	
72F	.034 In/Sec	.620 G-s	
73F	.066 In/Sec	2.499 G-s	
81F	.047 In/Sec	2.064 G-s	
82F	.053 In/Sec	2.103 G-s	
	TOTIMENT ATD COMPRESSOR	(29 - D - 21)	
new AC - INS	TROMENT AIR COMPRESSOR	(ZA-D6C-ST)	

		OVERAL	L LEVEL	1-3	20 KHz			
:	11	.150	In/Sec		962 G-s	1	780.0	RPM
:	12	.105	In/Sec	. 1	301 G-s			
	13	.058	In/Sec		530 G-s			
:	21	.139	In/Sec	1.4	497 G-s			
:	22	.070	In/Sec	. 1	356 G-s			
:	23	.044	In/Sec	. 1	316 G-s			
		OVERAL	L LEVEL	1-3	20 KHZ			
	71M	.200	In/Sec	7.1	871 G-s			
	72M	.221	In/Sec	7.3	378 G-s			
	73M	.147	In/Sec	3.4	404 G-s			
1	81M	.115	In/Sec	3.3	131 G-s			
1	82M	.291	In/Sec	6.1	730 G-s			
1	83M	.183	In/Sec	6.9	982 G-s			
	71F	.098	In/Sec	5.4	404 G-s			
	72F	. 222	In/Sec	8.	567 G-s			
	73F	.128	In/Sec	5.	587 G-s			
1	81F	.182	In/Sec	1.2	2 46 G-s			
1	82F	.210	In/Sec	1.	734 G-s			
1	83F	.170	In/Sec	3.0	040 G-s			
201-08A	-	COMPRESSOR, NASH	A 201-08A		(29-Dec-2)	L)		
		OVERAL	L LEVEL	1-3	20 KHz			
:	12	.060	In/Sec		218 G-s		506.3	RPM
	13	. 092	In/Sec		108 G-s			
:	21	.047	In/Sec		069 G-s			
:	22	.056	In/Sec		100 G-s			
:	23	.112	In/Sec	. ()55 G-s			
	71	.100	In/Sec		162 G-s			
	72	.138	In/Sec		297 G-s			
	73	.099	In/Sec		207 G-s			
1	81	.118	In/Sec		107 G-s			
1	82	.144	In/Sec		107 G-s			
1	83	.123	In/Sec		101 G-s			
202-05	-	NASH SEAL LIQUID	PUMP-A		(29-Dec-2)	L)		
		OVERAL	L LEVEL	1-:	20 KHz			
:	11	.015	In/Sec	. ()53 G-s	1	800.0	RPM
:	21	.018	In/Sec		106 G-s			
:	23	. 020	In/Sec	. ()38 G-s			
	71	.030	In/Sec	. ()47 G-s			
	72	.018	In/Sec	. ()41 G-s			
9002-10	-	D-HYDROGENATOR A	GITATOR		(29-Dec-2)	L)		
		OVERAL	L LEVEL	1-:	20 KHz			
	11	.076	In/Sec	. ()60 G-s	1	185.0	RPM
:	21	.061	In/Sec)89 G-s			
:	23	.047	In/Sec	. ()54 G-s			
		OVERAL	L LEVEL	1-:	20 KHZ			
:	31	.240	In/Sec		645 G-s			
:	31L	.277	In/Sec		663 G-s			
		OVERAL	L LEVEL	1-:	20 KHz			
	51	.217	In/Sec	•	107 G-s			
	51L	.231	In/Sec	•	101 G-s	:	100.0	RPM
	52	.234	In/Sec	.:	275 G-s			
	52L	.247	In/Sec		239 G-s			
	53	.087	In/Sec		380 G-s			

	53L	.026 In/Sec	.369 G-s	
	61	.241 In/Sec	.109 G-s	
	61L	.159 In/Sec	.116 G-s	
	81	.039 In/Sec	.034 G-s	
	82	.034 In/Sec	.030 G-s	
	83	.031 In/Sec	.171 G-s	
C1a	rificati	on Of Vibration Units:		
010	Acc	> G-s PK		
	Vel	> In/Sec PK		
Abbrev	viated La	st Measurement Summary ****************	*****	*
		Database: Arkema.rbm		
		Station: HYDROGEN		
		Route No. 1: H2 MONTHL	Y	
		Report Date: 03-Jan-22	07:48	
MEASU	JREMENT P	OINT OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
P2B	_	PUMP MEA CIRC EAST P2B	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.053 In/Sec	3.811 G-s	3585.0 RPM
	21	.061 In/Sec	2.732 G-s	
	23	.122 In/Sec	2.682 G-s	
	71	.135 In/Sec	2.236 G-s	
	72	.124 In/Sec	1.683 G-s	
P1A	-	PUMP BFW WEST P1A	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.136 In/Sec	.146 G-s	3600.0 RPM
	21	.142 In/Sec	./41 G-s	
	23	.336 In/Sec	.469 G-s	
	71	.156 In/Sec	.615 G-s	
	72	.168 IN/Sec	./5/ G-S	
	81	.208 In/Sec	.879 G-S	
	83	.066 In/Sec	1.009 G-s	
~ ~				
C2	-	FD BLOWER C2	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.406 In/Sec	.269 G-s	3600.0 RPM
	21	.365 In/Sec	.9// G-S	
	23	.263 IN/Sec	.827 G-S	
	81	.247 IN/Sec	1.925 G-s	
C1	-	ID -BLOWER C1	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.106 In/Sec	.217 G-s	1800.0 RPM
	21	.107 In/Sec	.635 G-s	
	23	.127 In/Sec	.917 G-s	
	71	.112 In/Sec	.690 G-s	
	72	.060 In/Sec	.732 G-s	

	81	.211 In/Sec	.535 G-s	
	82	.196 In/Sec	.929 G-s	
CTPC	-	CENTER COOLING TOWER PUMP	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.149 In/Sec	.846 G-s	1750.0 RPM
	21	.140 In/Sec	.606 G-s	
	23	.363 In/Sec	1.107 G-s	
	71	.394 In/Sec	.880 G-s	
	72	.175 In/Sec	.931 G-s	
CTPW	-	WEST COOLING TOWER PUMP	(29-Dec-21)	
		OVERALL LEVEL	1-20 KHz	
	11	.097 In/Sec	.412 G-s	1750.0 RPM
	21	.082 In/Sec	.488 G-s	
	23	.055 In/Sec	.785 G-s	
	71	.131 In/Sec	.964 G-s	
	72	.092 In/Sec	.909 G-s	

Clarification Of Vibration Units:

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