HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

February 14, 2022

Pennakem

Subject: February vibration service report

Most of the machines surveyed were found to be in good condition, with the exception of the following:

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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Observations

P 24 Big Blue Water Pump
The pump trend is still high again and is dominated by a shaft speed vibration in the horizontal with the overall above 0.6"/second velocity peak. The pump data still indicates possible looseness in the bearing fits as well as wear in the pump, such as imbalance, and vane pass, which we suspect is 5x RPM. The motor shows a 1x RPM vibration and a dominant 5x RPM vibration also in the horizontal. **Rated a Class III Defect.**

P24-85 North 85˚ Water Pump
The pump still has a slight shaft speed vibration which is dominant in the axial. There could be wear in the pump. Check all fasteners for now as well as the coupling and shaft run out. **Rated a Class I Defect.**

P 48-7B Roto jet High Pressure Pump
The pump vibration has dropped returned to normal. No other action is required.

C42-4 Twin Screw Axial Compressor
Non-synchronous vibration peaks are evident in the compressor bearing data. This is a good indication of early bearing race defects. No immediate action required at this time. **Rated a Class I Defect.**

R53-301 Reactor Agitator Motor and Gearbox
The Motor/Gearbox frame still appears to be cracked at the base on the south side. The agitator adapter shaft appears to have run out which most likely helped in the progression of the fatigue and subsequent crack. Repair the base and correct the shaft run out as soon as possible. **Rated a Class III Defect.**

R55-106 Reactor Agitator Motor Gearbox
Motor/gearbox has increased 1xRPM vibration at input speed. Inspect the fasteners, structure, coupling and alignment as time allows. **Rated a Class III Defect.**

B82-101A Forced Draft Fan Outside (Southwest)
Motor has a shaft speed vibration and a few harmonics. Check all fasteners and clean the fan wheel. **Rated a Class I Defect.**

P67-504 Hot Oil Circulation Pump 50 HP
The unit vibrations have dropped but still show a shaft speed vibration with a few low amplitude harmonics. We still suggest inspecting the unit fasteners, bearing housing fits, coupling and hubs, and shaft alignment. Check for run out. **Rated a Class II Defect.**

P39-4-877 Well Pump #4

Vibration data shows a large increase in vibration at shaft speed in the motor top measurement point 11 at almost 0.6”/second velocity peak overall. Unit could be suffering from multiple possible issues including imbalance, wear, run out, loose fasteners, cracked structures. Inspect for visual defects as time allows. We will watch for changes. **Rated a Class II Defect.**

Abbreviated Last Measurement Summary

Database: penn.rbm
Station: PENNAKEM NEW CURRENT DATABASE
Report Date: 14-Feb-22 09:51

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
B4C101-877 - ZURN BOILER BLOWER		(09-Feb-22)	
	OVERALL LEVEL	1-20 KHZ	
11	.191 In/Sec	.310 G-s	1180.0 RPM
12	.124 In/Sec	1.298 G-s	
13	.158 In/Sec	.539 G-s	
21	.197 In/Sec	.611 G-s	
22	.144 In/Sec	1.424 G-s	
23	.111 In/Sec	.758 G-s	
71	.183 In/Sec	1.977 G-s	
72	.116 In/Sec	.926 G-s	
73	.158 In/Sec	.453 G-s	
81	.156 In/Sec	2.024 G-s	
82	.134 In/Sec	.462 G-s	
83	.258 In/Sec	.601 G-s	
P4C-102B - BOILER FEEDWATER PUMP		(09-Feb-22)	
	OVERALL LEVEL	1-20 KHZ	
11	.179 In/Sec	.821 G-s	3570.0 RPM
12	.065 In/Sec	.881 G-s	
21	.067 In/Sec	.303 G-s	
22	.058 In/Sec	.280 G-s	
23	.061 In/Sec	.220 G-s	
71	.038 In/Sec	1.263 G-s	
72	.031 In/Sec	1.161 G-s	
73	.051 In/Sec	.748 G-s	
81	.180 In/Sec	1.668 G-s	
82	.055 In/Sec	1.050 G-s	
83	.074 In/Sec	2.198 G-s	
P24-102B - JOCKEY FIRE FLANGE PUMP HZ		(09-Feb-22)	
	OVERALL LEVEL	1-20 KHZ	
11	.144 In/Sec	.924 G-s	1785.0 RPM
12	.112 In/Sec	.677 G-s	
21	.066 In/Sec	.666 G-s	
22	.093 In/Sec	.538 G-s	

23	.070 In/Sec	.339 G-s	

P24-63DEGS - 63 DEG S WATER PUMP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.132 In/Sec	1.475 G-s	1750.0 RPM
12	.109 In/Sec	1.911 G-s	
21	.162 In/Sec	1.013 G-s	
22	.068 In/Sec	.813 G-s	
23	.123 In/Sec	.758 G-s	
71	.091 In/Sec	1.093 G-s	
72	.083 In/Sec	.993 G-s	
73	.198 In/Sec	2.086 G-s	
81	.102 In/Sec	1.825 G-s	
82	.062 In/Sec	1.998 G-s	
83	.089 In/Sec	1.191 G-s	

P24-85DEGN - 85 DEG N WATER CIRC PUMP 125 (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.098 In/Sec	2.073 G-s	1750.0 RPM
12	.054 In/Sec	.630 G-s	
21	.064 In/Sec	.929 G-s	
22	.070 In/Sec	1.006 G-s	
23	.060 In/Sec	1.085 G-s	
71	.173 In/Sec	.930 G-s	
72	.199 In/Sec	1.393 G-s	
73	.295 In/Sec	.898 G-s	
81	.105 In/Sec	.985 G-s	
82	.167 In/Sec	.892 G-s	
83	.261 In/Sec	.934 G-s	

P24-85DEGS - 85 DEG S WATER CIRC PUMP 125 (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.099 In/Sec	1.024 G-s	1750.0 RPM
12	.055 In/Sec	1.902 G-s	
21	.085 In/Sec	1.130 G-s	
22	.081 In/Sec	1.370 G-s	
23	.082 In/Sec	1.236 G-s	
71	.170 In/Sec	.794 G-s	
72	.133 In/Sec	.949 G-s	
73	.123 In/Sec	1.569 G-s	
81	.096 In/Sec	1.059 G-s	
82	.078 In/Sec	1.005 G-s	
83	.107 In/Sec	.273 G-s	

P24BGBL876 - BIG BLUE WATER PUMP-63 DEG (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.488 In/Sec	.926 G-s	1180.0 RPM
12	.068 In/Sec	.755 G-s	
21	.699 In/Sec	1.369 G-s	
22	.140 In/Sec	1.717 G-s	
23	.258 In/Sec	1.356 G-s	
71	.648 In/Sec	.381 G-s	
72	.146 In/Sec	.421 G-s	
73	.351 In/Sec	.439 G-s	
81	.599 In/Sec	.507 G-s	
82	.136 In/Sec	.810 G-s	
83	.275 In/Sec	.806 G-s	

P36-905C - N COOL TWR-EAST PUMP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.036 In/Sec	.295 G-s	1780.0 RPM
12	.025 In/Sec	.170 G-s	
21	.037 In/Sec	.655 G-s	
22	.023 In/Sec	.255 G-s	
23	.037 In/Sec	.468 G-s	
71	.067 In/Sec	.807 G-s	
72	.065 In/Sec	.879 G-s	
81	.079 In/Sec	1.078 G-s	
82	.097 In/Sec	1.053 G-s	
83	.107 In/Sec	1.548 G-s	

C36-SOUTH - UTILITY AIRCOMP ROTARY 150HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.075 In/Sec	2.283 G-s	1750.0 RPM
12	.076 In/Sec	1.665 G-s	
21	.127 In/Sec	1.404 G-s	
22	.132 In/Sec	1.406 G-s	
71	.095 In/Sec	1.571 G-s	3570.0 RPM
72	.108 In/Sec	1.141 G-s	
81	.087 In/Sec	1.843 G-s	
82	.196 In/Sec	2.604 G-s	

P39-4-877 - WELL PUMP #4 (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.572 In/Sec	1.063 G-s	1780.0 RPM
12	.320 In/Sec	.587 G-s	
13	.132 In/Sec	.358 G-s	
21	.224 In/Sec	.513 G-s	
22	.172 In/Sec	.571 G-s	
23	.101 In/Sec	.338 G-s	

C42-4 - AXIAL TWIN SCREW COMPRESSOR (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.092 In/Sec	2.332 G-s	1185.0 RPM
12	.047 In/Sec	1.532 G-s	1750.0 RPM
21	.076 In/Sec	1.131 G-s	
22	.055 In/Sec	1.637 G-s	
23	.064 In/Sec	1.574 G-s	
71	.120 In/Sec	3.779 G-s	3570.0 RPM
72	.098 In/Sec	2.223 G-s	
73	.134 In/Sec	4.406 G-s	
81	.113 In/Sec	2.270 G-s	
82	.131 In/Sec	.406 G-s	
83	.134 In/Sec	2.613 G-s	
71F	.116 In/Sec	2.561 G-s	
72F	.071 In/Sec	2.116 G-s	
81F	.200 In/Sec	1.165 G-s	
82F	.076 In/Sec	1.670 G-s	
83F	.124 In/Sec	3.397 G-s	

P42-4A - CENTRIFUGAL HOT OIL PUMP 5HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.024 In/Sec	.094 G-s	1760.0 RPM
21	.012 In/Sec	.072 G-s	

	23	.015 In/Sec	.088 G-s	
	71	.016 In/Sec	.200 G-s	
	73	.021 In/Sec	.070 G-s	
	81	.016 In/Sec	.083 G-s	

P42-4B - CENTRIFUGAL HOT OIL PUMP 5HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.029 In/Sec	.039 G-s	1760.0 RPM
21	.020 In/Sec	.176 G-s	
23	.116 In/Sec	.071 G-s	
71	.023 In/Sec	.131 G-s	
73	.019 In/Sec	.032 G-s	
81	.023 In/Sec	.059 G-s	

P42-4D - CENTRIFUGAL HOT OIL PUMP 5HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.046 In/Sec	.113 G-s	1760.0 RPM
21	.045 In/Sec	.295 G-s	
23	.026 In/Sec	.107 G-s	
71	.030 In/Sec	.109 G-s	
81	.025 In/Sec	.058 G-s	

P48-7B - ROTOJET HIGH PRESS PUMP 15HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.175 In/Sec	.532 G-s	1750.0 RPM
12	.110 In/Sec	.219 G-s	
21	.152 In/Sec	1.154 G-s	
22	.057 In/Sec	.529 G-s	
23	.131 In/Sec	.629 G-s	
71	.197 In/Sec	2.402 G-s	4723.0 RPM
72	.120 In/Sec	1.772 G-s	
81	.296 In/Sec	1.810 G-s	
82	.102 In/Sec	.733 G-s	
83	.145 In/Sec	1.036 G-s	

C53-1A-050 - C1-A H2 COMPRESSOR (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.111 In/Sec	2.336 G-s	1800.0 RPM
12	.039 In/Sec	1.014 G-s	
21	.116 In/Sec	2.163 G-s	
22	.092 In/Sec	1.299 G-s	
23	.081 In/Sec	.957 G-s	
71	.120 In/Sec	.054 G-s	
72	.024 In/Sec	.040 G-s	
81	.137 In/Sec	.033 G-s	
82	.016 In/Sec	.026 G-s	
83	.075 In/Sec	.052 G-s	

C53-301A - C-301A RECIP COMPRESSOR (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.071 In/Sec	.816 G-s	1800.0 RPM
12	.094 In/Sec	.837 G-s	
21	.086 In/Sec	.475 G-s	
22	.125 In/Sec	.328 G-s	
71	.091 In/Sec	.098 G-s	325.0 RPM
72	.087 In/Sec	.170 G-s	
73	.146 In/Sec	.274 G-s	

81	.091 In/Sec	.204 G-s	
82	.087 In/Sec	.180 G-s	
83	.145 In/Sec	.234 G-s	

P53-301 - ANSI CENTRIFUGAL PUMP 50 HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.091 In/Sec	.144 G-s	1750.0 RPM
12	.058 In/Sec	.170 G-s	
21	.112 In/Sec	.422 G-s	
22	.095 In/Sec	.282 G-s	
23	.072 In/Sec	.173 G-s	
71	.062 In/Sec	.893 G-s	
72	.069 In/Sec	.322 G-s	
73	.069 In/Sec	.555 G-s	
81	.052 In/Sec	.435 G-s	
82	.055 In/Sec	.519 G-s	
83	.054 In/Sec	.484 G-s	

R53-301 - AGITATOR GBX CHEMINEER 15HP (09-Feb-22)

	OVERALL LEVEL		
11	.505 In/Sec		1760.0 RPM
12	.198 In/Sec		
21	.542 In/Sec		
22	.323 In/Sec		
31	.387 In/Sec		
32	.178 In/Sec		
33	.125 In/Sec		
41	.329 In/Sec		
42	.098 In/Sec		
51	.129 In/Sec		
61	.420 In/Sec		
63	.095 In/Sec		
71	.234 In/Sec		

P53-310A - GRUNDFOSS VERT PUMP 10HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.089 In/Sec	.046 G-s	1750.0 RPM
12	.058 In/Sec	.176 G-s	
21	.054 In/Sec	.221 G-s	
22	.045 In/Sec	.238 G-s	
23	.029 In/Sec	.456 G-s	
71	.074 In/Sec	.185 G-s	
72	.056 In/Sec	.250 G-s	
73	.023 In/Sec	.078 G-s	
81	.044 In/Sec	.220 G-s	
82	.016 In/Sec	.190 G-s	

C54--115 - COMP 2CYL 2 STAGE 75 HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.083 In/Sec	.789 G-s	1800.0 RPM
12	.155 In/Sec	.351 G-s	
13	.171 In/Sec	.426 G-s	
21	.080 In/Sec	.783 G-s	
22	.060 In/Sec	.196 G-s	
23	.178 In/Sec	.230 G-s	
71	.030 In/Sec	.060 G-s	
72	.022 In/Sec	.041 G-s	

73	.025 In/Sec	.032 G-s	
81	.061 In/Sec	.039 G-s	
82	.035 In/Sec	.043 G-s	
83	.042 In/Sec	.076 G-s	

P54-112 - CANNED MOTOR CENTRIFUG PUMP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.037 In/Sec	.031 G-s	1800.0 RPM
12	.019 In/Sec	.042 G-s	
13	.017 In/Sec	.246 G-s	
21	.026 In/Sec	.104 G-s	
22	.014 In/Sec	.131 G-s	
23	.054 In/Sec	.068 G-s	
71	.026 In/Sec	.078 G-s	
72	.063 In/Sec	.078 G-s	
81	.034 In/Sec	.050 G-s	
82	.021 In/Sec	.014 G-s	
83	.040 In/Sec	.034 G-s	

R55-101 - AGITATOR GBX AND MOTOR (09-Feb-22)

	OVERALL LEVEL	
11	.161 In/Sec	1760.0 RPM
12	.081 In/Sec	
13	.223 In/Sec	
21	.148 In/Sec	
22	.056 In/Sec	
23	.121 In/Sec	
31	.146 In/Sec	
32	.171 In/Sec	
33	.017 In/Sec	
41	.212 In/Sec	
42	.245 In/Sec	
43	.047 In/Sec	
51	.047 In/Sec	
52	.056 In/Sec	

R55-104 - REACTOR AGIT R-104 (B55) (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.051 In/Sec	.380 G-s	1760.0 RPM
12	.033 In/Sec	.205 G-s	
13	.027 In/Sec	.275 G-s	
21	.051 In/Sec	.539 G-s	
22	.030 In/Sec	.664 G-s	
23	.064 In/Sec	.154 G-s	
31	.036 In/Sec		
32	.020 In/Sec		
33	.042 In/Sec		
41	.033 In/Sec		
42	.014 In/Sec		
43	.029 In/Sec		
51	.038 In/Sec		
61	.031 In/Sec		

R55-106 - REACTOR AGIT R-106 (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.354 In/Sec	.321 G-s	1760.0 RPM
12	.734 In/Sec		

	21	.223 In/Sec	.144 G-s	
	22	.281 In/Sec	.068 G-s	
	23	.534 In/Sec	.138 G-s	
	31	.199 In/Sec		
	32	.288 In/Sec		
	33	.206 In/Sec		
	41	.404 In/Sec		

C67-51 - AXIAL TWIN SCREW COMPRESSOR (27-Dec-21)

		OVERALL LEVEL	1-20 KHZ	
*	13	.094 In/Sec	.661 G-s	1750.0 RPM

P67-54 - HOT OIL CIRC PMP CENT 15HP (09-Feb-22)

		OVERALL LEVEL	1-20 KHZ	
	11	.116 In/Sec	.389 G-s	1750.0 RPM
	12	.049 In/Sec	.286 G-s	
	21	.114 In/Sec	.205 G-s	
	22	.018 In/Sec	.141 G-s	
	23	.037 In/Sec	.088 G-s	
	71	.101 In/Sec	.347 G-s	
	72	.060 In/Sec	.205 G-s	
	73	.044 In/Sec	.404 G-s	
	81	.083 In/Sec	.319 G-s	
	82	.033 In/Sec	.202 G-s	
	83	.060 In/Sec	.256 G-s	

P67-504 - HOT OIL CIRC PMP CENT 50HP (09-Feb-22)

		OVERALL LEVEL	1-20 KHZ	
	11	.170 In/Sec	.248 G-s	1750.0 RPM
	12	.113 In/Sec	.258 G-s	
	13	.190 In/Sec	.108 G-s	
	21	.241 In/Sec	.421 G-s	
	22	.149 In/Sec	.179 G-s	
	23	.163 In/Sec	.341 G-s	
	71	.141 In/Sec	.403 G-s	
	72	.178 In/Sec	.431 G-s	
	73	.118 In/Sec	.307 G-s	
	81	.093 In/Sec	.299 G-s	
	82	.133 In/Sec	.245 G-s	
	83	.078 In/Sec	.176 G-s	

R80-30 - AGITATOR GBX 15HP CHEMINEER (09-Feb-22)

		OVERALL LEVEL		
	11	.109 In/Sec		1760.0 RPM
	12	.131 In/Sec		
	21	.078 In/Sec		
	22	.076 In/Sec		
	31	.043 In/Sec		
	41	.054 In/Sec		
	51	.038 In/Sec		
	52	.030 In/Sec		

B82-101A - FAN FORCED DRAFT 10HP SOUTH (09-Feb-22)

		OVERALL LEVEL	1-20 KHZ	
	11	.096 In/Sec	.193 G-s	1800.0 RPM
	12	.220 In/Sec	.123 G-s	
*	13	.264 In/Sec	.091 G-s	

21	.175 In/Sec	.208 G-s	
22	.325 In/Sec	.183 G-s	
23	.392 In/Sec	.160 G-s	

B82-102 - INDUCED DRAFT 150 HP (09-Feb-22)

	OVERALL LEVEL	1-20 KHZ	
11	.034 In/Sec	.164 G-s	1800.0 RPM
12	.039 In/Sec	.094 G-s	
21	.047 In/Sec	.348 G-s	
22	.051 In/Sec	.418 G-s	
23	.037 In/Sec	.203 G-s	
31	.036 In/Sec	.296 G-s	
32	.048 In/Sec	.074 G-s	
41	.027 In/Sec	.177 G-s	
42	.070 In/Sec	.065 G-s	

Clarification Of Vibration Units:

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

* - Indicates Data Has Date/Time Different From Machine Date/Time