HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

April 30, 2021

Penn A Kem

Subject: April 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

C67-51 Twin Screw Axial Compressor
Vibration data for the inboard motor bearing still shows synchronous and non-synchronous peaks. We suspect bearing defect frequencies are present. Overall acceleration has dropped to 3 g's RMS. No immediate action is required; however, we are keeping this a **Class II Defect for now.**

P 24 Big Blue Water Pump
The pump data still indicates possible slight 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 data for the inboard bearing shows what we believe to be bearing fundamental outer race defect frequency and harmonics. **Rated a Class II Defect.**

P24-85 Degree Pump South
The pump axial vibration is elevated. The acceleration trend is over 4 g's RMS but looks to be cavitation noise. Ensure the pump is running at BOP. Please note that this is the first data since last June. **Rated a Class I Defect.**

R53-301 Reactor Agitator Motor and Gearbox
The motor vibrations are almost all near 0.5"/sec velocity peak. The vibrations are dominated by shaft speed and the first two harmonics. This usually indicates a coupling and/or an alignment issue. We recommend inspecting the motor and coupling, and check the shaft alignment, fasteners and frame as time allows. **Rated a Class II Defect.**

CHLR45-1 20 Ton Trane Chiller
The East and West compressors were running and vibrating at over 1.0"/sec velocity peak at 60 Hz shaft speed. Vibrations at these levels in either unit will likely cause a reduced lifespan. Have the unit checked for compliance with the manufacture's specification. **Rated a Class I Defect**

B82-101A South West FD Fan (Outside)
The motor axial has a sub-synchronous vibration at near half speed of the shaft. This could be a rub or possible looseness or an issue with the fan wheel. We recommend cleaning and inspecting the fan wheel/hub and check all fasteners. **Rated a Class I Defect.**

R80-10 Agitator Motor and Gearbox
The motor vibration data is very low, but we feel there is an issue in the bearings. Ensure the bearings are lubricated if applicable. Consider changing the motor out. **Rated a Class II Defect.**

R80-10 Agitator Motor and Gearbox
The motor has a dominant shaft speed vibration. Inspect the coupling fasteners and alignment as time allows. **Rated a Class I Defect.**

Abbreviated Last Measurement Summary
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Database: penn.rbm
Station: PENNAKEM NEW CURRENT DATABASE
Report Date: 04-May-21 09:18

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
B4C101-877 - ZURN BOILER BLOWER	**(28-Apr-21)**		
	OVERALL LEVEL	**1-20 KHZ**	
11	.179 In/Sec	.450 G-s	1180.0 RPM
12	.126 In/Sec	.472 G-s	
13	.140 In/Sec	.163 G-s	
21	.181 In/Sec	.690 G-s	
22	.134 In/Sec	1.527 G-s	
23	.121 In/Sec	.883 G-s	
71	.170 In/Sec	1.438 G-s	
72	.107 In/Sec	1.078 G-s	
73	.150 In/Sec	.714 G-s	
81	.164 In/Sec	.711 G-s	
82	.108 In/Sec	.251 G-s	
83	.126 In/Sec	.602 G-s	
P4C-102A - BOILER FEEDWATER PUMP	**(28-Apr-21)**		
	OVERALL LEVEL	**1-20 KHZ**	
11	.039 In/Sec	.909 G-s	3570.0 RPM
12	.036 In/Sec	.787 G-s	
21	.039 In/Sec	.510 G-s	
22	.032 In/Sec	.597 G-s	
23	.046 In/Sec	.535 G-s	
71	.070 In/Sec	.638 G-s	
72	.030 In/Sec	.442 G-s	
73	.055 In/Sec	.557 G-s	
81	.076 In/Sec	.462 G-s	
82	.037 In/Sec	.471 G-s	
83	.065 In/Sec	1.128 G-s	
P24-102B - JOCKEY FIRE FLANGE PUMP HZ	**(28-Apr-21)**		
	OVERALL LEVEL	**1-20 KHZ**	
11	.087 In/Sec	.223 G-s	1785.0 RPM
12	.095 In/Sec	.382 G-s	
21	.054 In/Sec	.094 G-s	
22	.057 In/Sec	.199 G-s	
23	.059 In/Sec	.045 G-s	

P24-63DEGN - 63 DEG N WATER PUMP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.062 In/Sec	.282 G-s	1750.0 RPM
12	.042 In/Sec	.588 G-s	
21	.060 In/Sec	.468 G-s	
22	.056 In/Sec	.421 G-s	
23	.048 In/Sec	.469 G-s	
71	.075 In/Sec	.730 G-s	
72	.030 In/Sec	1.022 G-s	
73	.160 In/Sec	1.492 G-s	
81	.064 In/Sec	.618 G-s	
82	.035 In/Sec	.800 G-s	
83	.099 In/Sec	1.091 G-s	

P24-63DEGS - 63 DEG S WATER PUMP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.081 In/Sec	.439 G-s	1750.0 RPM
12	.125 In/Sec	.266 G-s	
21	.105 In/Sec	.526 G-s	
22	.051 In/Sec	.560 G-s	
23	.110 In/Sec	.291 G-s	
71	.104 In/Sec	.140 G-s	
72	.059 In/Sec	.426 G-s	
73	.080 In/Sec	.979 G-s	
81	.070 In/Sec	.502 G-s	
82	.038 In/Sec	.447 G-s	
83	.121 In/Sec	.941 G-s	

P24-85DEGS - 85 DEG S WATER CIRC PUMP 125 (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.060 In/Sec	.632 G-s	1750.0 RPM
12	.275 In/Sec	.545 G-s	
21	.045 In/Sec	.659 G-s	
22	.132 In/Sec	1.126 G-s	
23	.061 In/Sec	.719 G-s	
71	.109 In/Sec	2.783 G-s	
72	.121 In/Sec	2.661 G-s	
73	.206 In/Sec	4.191 G-s	
81	.105 In/Sec	1.424 G-s	
82	.130 In/Sec	1.480 G-s	
83	.183 In/Sec	2.730 G-s	

P24BGBL876 - BIG BLUE WATER PUMP-63 DEG (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.223 In/Sec	1.187 G-s	1180.0 RPM
12	.059 In/Sec	1.811 G-s	
21	.277 In/Sec	2.729 G-s	
22	.075 In/Sec	1.946 G-s	
23	.109 In/Sec	1.093 G-s	
71	.347 In/Sec	.423 G-s	
72	.178 In/Sec	.509 G-s	
73	.247 In/Sec	.277 G-s	
81	.271 In/Sec	.488 G-s	
82	.202 In/Sec	.585 G-s	
83	.130 In/Sec	.516 G-s	

P36-905A - N COOL TWR-NORTH PUMP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.075 In/Sec	.265 G-s	1780.0 RPM
12	.048 In/Sec	.565 G-s	
21	.078 In/Sec	.744 G-s	
22	.064 In/Sec	.593 G-s	
23	.061 In/Sec	.283 G-s	
71	.093 In/Sec	2.064 G-s	
72	.082 In/Sec	1.300 G-s	
73	.155 In/Sec	.435 G-s	
81	.125 In/Sec	1.676 G-s	
82	.115 In/Sec	1.223 G-s	
83	.169 In/Sec	2.386 G-s	

P36-905C - N COOL TWR-EAST PUMP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.052 In/Sec	.167 G-s	1780.0 RPM
12	.040 In/Sec	.276 G-s	
21	.044 In/Sec	.568 G-s	
22	.029 In/Sec	.142 G-s	
23	.038 In/Sec	.153 G-s	
71	.160 In/Sec	1.528 G-s	
72	.128 In/Sec	1.324 G-s	
73	.235 In/Sec	.400 G-s	
81	.163 In/Sec	.656 G-s	
82	.146 In/Sec	.626 G-s	
83	.198 In/Sec	1.168 G-s	

C36-SOUTH - UTILITY AIRCOMP ROTARY 150HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.061 In/Sec	.576 G-s	1750.0 RPM
12	.070 In/Sec	.871 G-s	
21	.077 In/Sec	.805 G-s	
22	.097 In/Sec	.838 G-s	
23	.084 In/Sec	1.062 G-s	
71	.060 In/Sec	.827 G-s	3570.0 RPM
72	.111 In/Sec	1.431 G-s	
73	.178 In/Sec	3.789 G-s	
81	.094 In/Sec	1.369 G-s	
82	.094 In/Sec	1.599 G-s	
71F	.121 In/Sec	2.286 G-s	
72F	.106 In/Sec	2.101 G-s	
81F	.090 In/Sec	1.159 G-s	
82F	.118 In/Sec	1.506 G-s	

C36-WEST - UTILITY AIRCOMP ROTARY 150HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.077 In/Sec	.813 G-s	1750.0 RPM
12	.066 In/Sec	1.021 G-s	
21	.103 In/Sec	.413 G-s	
22	.097 In/Sec	.883 G-s	
23	.119 In/Sec	1.307 G-s	
71	.096 In/Sec	1.069 G-s	3570.0 RPM
72	.093 In/Sec	1.590 G-s	
73	.167 In/Sec	1.502 G-s	
81	.071 In/Sec	1.206 G-s	
82	.083 In/Sec	1.543 G-s	

	71F	.081 In/Sec	2.101 G-s	
	72F	.090 In/Sec	1.571 G-s	
	81F	.101 In/Sec	.985 G-s	
	82F	.120 In/Sec	1.532 G-s	

P42-4A - CENTRIFUGAL HOT OIL PUMP 5HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.012 In/Sec	.066 G-s	1760.0 RPM
21	.024 In/Sec	.047 G-s	
23	.056 In/Sec	.047 G-s	
71	.019 In/Sec	.636 G-s	
73	.013 In/Sec	.184 G-s	
81	.012 In/Sec	.237 G-s	

P42-4B - CENTRIFUGAL HOT OIL PUMP 5HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.053 In/Sec	.016 G-s	1760.0 RPM
21	.033 In/Sec	.052 G-s	
23	.063 In/Sec	.067 G-s	
71	.042 In/Sec	.059 G-s	
73	.019 In/Sec	.031 G-s	
81	.035 In/Sec	.038 G-s	

P42-4D - CENTRIFUGAL HOT OIL PUMP 5HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.020 In/Sec	.120 G-s	1760.0 RPM
21	.021 In/Sec	.090 G-s	
23	.027 In/Sec	.067 G-s	
71	.023 In/Sec	.164 G-s	
81	.028 In/Sec	.062 G-s	

C53-301A - C-301A RECIP COMPRESSOR (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.097 In/Sec	1.148 G-s	1800.0 RPM
12	.090 In/Sec	.515 G-s	
13	.155 In/Sec	.076 G-s	
21	.110 In/Sec	.255 G-s	
22	.154 In/Sec	.403 G-s	
23	.110 In/Sec	.753 G-s	
71	.096 In/Sec	.275 G-s	325.0 RPM
72	.076 In/Sec	.133 G-s	
73	.196 In/Sec	.153 G-s	
81	.103 In/Sec	.298 G-s	
82	.080 In/Sec	.108 G-s	

P53-301 - ANSI CENTRIFUGAL PUMP 50 HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.103 In/Sec	.090 G-s	1750.0 RPM
12	.071 In/Sec	.121 G-s	
21	.077 In/Sec	.594 G-s	
22	.108 In/Sec	.293 G-s	
23	.087 In/Sec	.156 G-s	
71	.096 In/Sec	.371 G-s	
72	.148 In/Sec	.307 G-s	
73	.120 In/Sec	.706 G-s	
81	.055 In/Sec	.570 G-s	
82	.102 In/Sec	.449 G-s	

R53-301 - AGITATOR GBX CHEMINEER 15HP (28-Apr-21)

	OVERALL LEVEL		
11	.579 In/Sec		1760.0 RPM
12	.359 In/Sec		
21	.545 In/Sec		
22	.498 In/Sec		
23	.466 In/Sec		
31	.381 In/Sec		
32	.057 In/Sec		
33	.306 In/Sec		
41	.273 In/Sec		
42	.056 In/Sec		
51	.225 In/Sec		
61	.149 In/Sec		
63	.072 In/Sec		
71	.045 In/Sec		

P53-310A - GRUNDFOSS VERT PUMP 10HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.149 In/Sec	.313 G-s	1750.0 RPM
12	.117 In/Sec	.181 G-s	
21	.060 In/Sec	.672 G-s	
22	.065 In/Sec	.221 G-s	
23	.033 In/Sec	.166 G-s	
71	.134 In/Sec	.221 G-s	
72	.099 In/Sec	.265 G-s	
73	.025 In/Sec	.316 G-s	
81	.021 In/Sec	.080 G-s	
82	.023 In/Sec	.098 G-s	

C54--115 - COMP 2CYL 2 STAGE 75 HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.057 In/Sec	.503 G-s	1800.0 RPM
12	.154 In/Sec	.514 G-s	
21	.059 In/Sec	.748 G-s	
22	.050 In/Sec	.337 G-s	
23	.159 In/Sec	.181 G-s	
71	.028 In/Sec	.067 G-s	
72	.034 In/Sec	.050 G-s	
73	.059 In/Sec	.060 G-s	
81	.083 In/Sec	.058 G-s	
82	.028 In/Sec	.043 G-s	

P54-112 - CANNED MOTOR CENTRIFUG PUMP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.031 In/Sec	.040 G-s	1800.0 RPM
12	.019 In/Sec	.077 G-s	
13	.033 In/Sec	.023 G-s	
21	.025 In/Sec	.111 G-s	
22	.013 In/Sec	.124 G-s	
71	.026 In/Sec	.070 G-s	
72	.014 In/Sec	.064 G-s	
81	.024 In/Sec	.036 G-s	
82	.034 In/Sec	.032 G-s	

C67-51 - AXIAL TWIN SCREW COMPRESSOR (28-Apr-21)

		OVERALL LEVEL	1-20 KHZ	
	11	.056 In/Sec	1.196 G-s	1750.0 RPM
	12	.170 In/Sec	2.933 G-s	
	13	.063 In/Sec	1.429 G-s	
	21	.052 In/Sec	.858 G-s	
	22	.085 In/Sec	1.890 G-s	
	23	.071 In/Sec	1.316 G-s	
	71	.074 In/Sec	.035 G-s	3570.0 RPM
	72	.046 In/Sec	.0079 G-s	
	73	.085 In/Sec	.048 G-s	
	81	.108 In/Sec	.037 G-s	
	82	.045 In/Sec	.054 G-s	
	83	.060 In/Sec	.118 G-s	
	71F	.085 In/Sec	.020 G-s	
	72F	.057 In/Sec	.0081 G-s	
	73F	.050 In/Sec	.090 G-s	
	81F	.140 In/Sec	.015 G-s	
	82F	.046 In/Sec	.016 G-s	
	83F	.048 In/Sec	.037 G-s	

P67-54 - HOT OIL CIRC PMP CENT 15HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.190 In/Sec	.069 G-s	1750.0 RPM
71	.041 In/Sec	.419 G-s	
72	.034 In/Sec	.367 G-s	
73	.053 In/Sec	.217 G-s	
81	.034 In/Sec	.184 G-s	
82	.027 In/Sec	.191 G-s	

P67-504 - HOT OIL CIRC PMP CENT 50HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.081 In/Sec	.130 G-s	1750.0 RPM
12	.050 In/Sec	.167 G-s	
13	.086 In/Sec	.095 G-s	
21	.080 In/Sec	.199 G-s	
22	.069 In/Sec	.359 G-s	
23	.092 In/Sec	.082 G-s	
71	.195 In/Sec	.111 G-s	
72	.082 In/Sec	.123 G-s	
73	.066 In/Sec	.110 G-s	
81	.081 In/Sec	.164 G-s	
82	.055 In/Sec	.125 G-s	

R80-10 - AGITATOR GBX (28-Apr-21)

	OVERALL LEVEL	
11	.083 In/Sec	1760.0 RPM
12	.108 In/Sec	
13	.055 In/Sec	
21	.068 In/Sec	
22	.060 In/Sec	
23	.061 In/Sec	
31	.061 In/Sec	
32	.056 In/Sec	
33	.055 In/Sec	
41	.052 In/Sec	
42	.055 In/Sec	
43	.045 In/Sec	

	51	.057 In/Sec		
	52	.048 In/Sec		
	61	.057 In/Sec		
	62	.031 In/Sec		
	63	.045 In/Sec		
	71	.021 In/Sec		
	72	.020 In/Sec		

R80-30 - AGITATOR GBX 15HP CHEMINEER (28-Apr-21)

	OVERALL LEVEL		
11	.170 In/Sec		1760.0 RPM
12	.357 In/Sec		
21	.095 In/Sec		
22	.133 In/Sec		
23	.145 In/Sec		
31	.074 In/Sec		
32	.031 In/Sec		
33	.108 In/Sec		
41	.064 In/Sec		
42	.036 In/Sec		
51	.071 In/Sec		
61	.051 In/Sec		
62	.062 In/Sec		
71	.036 In/Sec		

B82-101A - FAN FORCED DRAFT 10HP SOUTH (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.158 In/Sec	.032 G-s	1800.0 RPM
12	.188 In/Sec	.056 G-s	
* 13	.264 In/Sec	.091 G-s	
21	.234 In/Sec	.180 G-s	
22	.302 In/Sec	.054 G-s	
23	.386 In/Sec	.098 G-s	

B82-102 - INDUCED DRAFT 150 HP (28-Apr-21)

	OVERALL LEVEL	1-20 KHZ	
11	.040 In/Sec	.090 G-s	1800.0 RPM
12	.032 In/Sec	.079 G-s	
21	.045 In/Sec	.350 G-s	
22	.057 In/Sec	.495 G-s	
23	.043 In/Sec	.252 G-s	
31	.029 In/Sec	.225 G-s	
32	.040 In/Sec	.624 G-s	
33	.034 In/Sec	.175 G-s	
41	.027 In/Sec	.158 G-s	
42	.021 In/Sec	.163 G-s	

CHLR67-1W - 240T TRANE CHILLER WEST (28-Apr-21)

	OVERALL LEVEL		
11	.171 In/Sec		3570.0 RPM
12	.171 In/Sec		
13	.205 In/Sec		
21	.150 In/Sec		
22	.169 In/Sec		
71	.095 In/Sec		
72	.120 In/Sec		
81	.130 In/Sec		

82	.172 In/Sec		

CHLR67-1E - 240T TRANE CHILLER EAST (28-Apr-21)

	OVERALL LEVEL		
11	.126 In/Sec		3570.0 RPM
12	.113 In/Sec		
13	.108 In/Sec		
21	.079 In/Sec		
22	.093 In/Sec		
71	.068 In/Sec		
72	.052 In/Sec		
81	.087 In/Sec		
82	.107 In/Sec		

CHLR45-1 - 20T TRANE CHILLER (28-Apr-21)

	OVERALL LEVEL		
11W	1.601 In/Sec		3570.0 RPM
12W	.532 In/Sec		
13W	.704 In/Sec		
11E	1.234 In/Sec		
12E	.882 In/Sec		
13E	.354 In/Sec		

Clarification Of Vibration Units:

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

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