HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

July 13, 2021

Tetra Technologies

Subject: July vibration service report

Most of the machines surveyed were found to be in good condition with the exception of the following: Supporting data included.

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,

David W Shook

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

Reportable equipment

Pump 421
Motor data still shows low amplitude non-synchronous harmonic vibrations that could be early bearing defects, and also what looks to be possible drive issues. There is one small peak at 2x line frequency and another one at just over 1 KHz. Both could be drive related. Check the drive for proper operation as time allows. No other actions are required. **Rated a Class II Defect for now.**

Pump 416
Data still shows a dominant 5x RPM vibration in the drive end of the pump. (Most likely 5 vanes on pump impeller). Check pump for proper operational parameters. **Rated a Class I Defect.**

Pump 501
Motor data still shows non-synchronous harmonic vibrations that could be bearing defects. We will watch this unit for changes. Ensure the bearing are lubricated if applicable. No other actions are required. **Rated a Class I Defect for now.**

Pump 415
Data shows what looks to be low amplitude harmonics of a 2x RPM vibration peak in the motor inboard vertical measurement. Check fasteners and possibly alignment as time allows. Please confirm unit RPM. **Rated a Class I Defect.**

Pump 602
Motor data still shows low amplitude non-synchronous harmonic vibrations that could be bearing defects. There could be some electrical related issues also present. We will watch this unit for changes. Ensure the bearing are lubricated if applicable. No other actions are required. **Rated a Class I Defect.**

Reported last month but not running this survey

Pump 305
Data shows low amplitude shaft speed harmonics and an elevated noise floor. We suspect recirculation and or cavitation. Check pump for proper operation. Motor data also shows non-synchronous harmonics which could indicate early distress in the bearings as well as rotor bar passing frequencies which are not an issue at this time. **Rated a Class I Defect.**

Pump 307
Data shows a dominant shaft speed vibration in the pump input bearing. Check the fasteners, coupling and alignment as time allows. **Rated a Class I Defect.**

Pump 706
Data shows a dominant 5x RPM vibration. (Most likely 5 vanes on pump impeller). There is also two harmonics. Check pump for proper operational parameters. Pump could have some impeller wear or looseness. **Rated a Class I Defect.**

Abbreviated Last Measurement Summary
****

Database: TETRA TECHNOLOGIES.rbm
Area: TETRA NEW
Route No. 1: NEW TETRA
Report Date: 13-Jul-21 12:11

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	EQUIPMENT SPEED
424 - PUMP 424		(13-Jul-21)	
	OVERALL LEVEL	1 - 20 KHz	
MOH	.032 In/Sec	.591 G-s	1785.0 RPM
MOV	.035 In/Sec	.201 G-s	
MIH	.025 In/Sec	.412 G-s	
MIV	.034 In/Sec	.348 G-s	
MIA	.029 In/Sec	.430 G-s	
EIA	.040 In/Sec	.132 G-s	
EIH	.046 In/Sec	.526 G-s	
EIV	.037 In/Sec	.203 G-s	
EOH	.028 In/Sec	.286 G-s	
EOV	.030 In/Sec	.268 G-s	
421 - PUMP 421		(13-Jul-21)	
	OVERALL LEVEL	1 - 20 KHz	
MOH	.027 In/Sec	.768 G-s	1785.0 RPM
MOV	.039 In/Sec	.204 G-s	
MIH	.028 In/Sec	.398 G-s	
MIV	.055 In/Sec	.126 G-s	
MIA	.025 In/Sec	.288 G-s	
EIA	.045 In/Sec	.172 G-s	
EIH	.059 In/Sec	.277 G-s	
EIV	.060 In/Sec	.092 G-s	
EOH	.031 In/Sec	.287 G-s	
EOV	.066 In/Sec	.213 G-s	
312 - PUMP 312		(13-Jul-21)	
	OVERALL LEVEL	1 - 20 KHz	
MOH	.048 In/Sec	.657 G-s	1785.0 RPM
MOV	.087 In/Sec	.781 G-s	
MIH	.058 In/Sec	1.018 G-s	
MIV	.105 In/Sec	.616 G-s	
MIA	.040 In/Sec	.568 G-s	
EIA	.039 In/Sec	.048 G-s	

	EIH	.044 In/Sec	.095 G-s	
	EIV	.040 In/Sec	.043 G-s	
	EOH	.034 In/Sec	.099 G-s	
	EOV	.037 In/Sec	.210 G-s	
300	- PUMP 300		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.023 In/Sec	.349 G-s	1785.0 RPM
	MOV	.026 In/Sec	.224 G-s	
	MIH	.023 In/Sec	.229 G-s	
	MIV	.038 In/Sec	.340 G-s	
	MIA	.043 In/Sec	.403 G-s	
	EIA	.032 In/Sec	.142 G-s	
	EIH	.041 In/Sec	.223 G-s	
	EIV	.057 In/Sec	.168 G-s	
	EOH	.020 In/Sec	.235 G-s	
	EOV	.034 In/Sec	.176 G-s	
301	- PUMP 301		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.018 In/Sec	.265 G-s	1785.0 RPM
	MOV	.022 In/Sec	.116 G-s	
	MIH	.014 In/Sec	.206 G-s	
	MIV	.022 In/Sec	.076 G-s	
	MIA	.014 In/Sec	.044 G-s	
	EIA	.027 In/Sec	.080 G-s	
	EIH	.049 In/Sec	.198 G-s	
	EIV	.032 In/Sec	.071 G-s	
	EOH	.021 In/Sec	.128 G-s	
	EOV	.053 In/Sec	.028 G-s	
314	- PUMP 314		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.017 In/Sec	.174 G-s	1785.0 RPM
	MOV	.012 In/Sec	.048 G-s	
	MIH	.019 In/Sec	.219 G-s	
	MIV	.011 In/Sec	.060 G-s	
	MIA	.0098 In/Sec	.072 G-s	
	EIA	.013 In/Sec	.015 G-s	
	EIH	.016 In/Sec	.052 G-s	
	EIV	.013 In/Sec	.020 G-s	
	EOH	.013 In/Sec	.031 G-s	
	EOV	.019 In/Sec	.012 G-s	
315	- PUMP 315		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.029 In/Sec	.098 G-s	1785.0 RPM
	MOV	.036 In/Sec	.211 G-s	
	MIH	.032 In/Sec	.084 G-s	
	MIV	.036 In/Sec	.033 G-s	
	MIA	.027 In/Sec	.045 G-s	
	EIA	.037 In/Sec	.144 G-s	
	EIH	.036 In/Sec	.249 G-s	
	EIV	.035 In/Sec	.128 G-s	
	EOH	.036 In/Sec	.235 G-s	
	EOV	.038 In/Sec	.199 G-s	

416	- PUMP 416		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.035 In/Sec	.726 G-s	1785.0 RPM
	MOV	.070 In/Sec	.102 G-s	
	MIH	.051 In/Sec	.457 G-s	
	MIV	.078 In/Sec	.108 G-s	
	MIA	.086 In/Sec	.346 G-s	
	EIA	.118 In/Sec	.186 G-s	
	EIH	.213 In/Sec	.331 G-s	
	EIV	.072 In/Sec	.239 G-s	
	EOH	.098 In/Sec	.378 G-s	
	EOV	.062 In/Sec	.150 G-s	
501	- PUMP 501		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.057 In/Sec	2.058 G-s	1785.0 RPM
	MOV	.040 In/Sec	.360 G-s	
	MIH	.057 In/Sec	1.368 G-s	
	MIV	.071 In/Sec	.221 G-s	
	MIA	.079 In/Sec	.689 G-s	
	EIA	.062 In/Sec	.041 G-s	
	EIH	.066 In/Sec	.081 G-s	
	EIV	.041 In/Sec	.030 G-s	
	EOH	.037 In/Sec	.118 G-s	
	EOV	.047 In/Sec	.170 G-s	
415	- PUMP 415		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.087 In/Sec	.330 G-s	1785.0 RPM
	MOV	.095 In/Sec	.192 G-s	
	MIH	.090 In/Sec	.451 G-s	
	MIV	.142 In/Sec	.209 G-s	
	MIA	.095 In/Sec	.188 G-s	
	EIA	.040 In/Sec	.346 G-s	
	EIH	.061 In/Sec	.201 G-s	
	EIV	.035 In/Sec	.317 G-s	
	EOH	.045 In/Sec	.254 G-s	
	EOV	.035 In/Sec	.314 G-s	
602	- AMMONIA PUMP 602		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.025 In/Sec	1.367 G-s	1785.0 RPM
	MOV	.050 In/Sec	.082 G-s	
	MIH	.037 In/Sec	.821 G-s	
	MIV	.084 In/Sec	.131 G-s	
	MIA	.030 In/Sec	.219 G-s	
	EIA	.047 In/Sec	.152 G-s	
	EIH	.046 In/Sec	.343 G-s	
	EIV	.056 In/Sec	.202 G-s	
	EOH	.029 In/Sec	.274 G-s	
	EOV	.033 In/Sec	.156 G-s	
402	- PUMP 402		(13-Jul-21)	
		OVERALL LEVEL	1 - 20 KHz	
	MOH	.048 In/Sec	.785 G-s	1785.0 RPM
	MOV	.054 In/Sec	.166 G-s	
	MIH	.049 In/Sec	.623 G-s	

MIV	.050 In/Sec	.144 G-s
MIA	.017 In/Sec	.300 G-s
EIA	.100 In/Sec	.051 G-s
EIH	.049 In/Sec	.194 G-s
EIV	.089 In/Sec	.106 G-s
EOH	.026 In/Sec	.149 G-s
EOV	.034 In/Sec	.100 G-s

Clarification Of Vibration Units:

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