HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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July 13, 2022

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The following is a summary of findings from the July 2022 WEEK 2 vibration survey at the H2O2 Plant that was performed on July 8, 2022. Please note that the X Storage Pump looked much better this survey.

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.

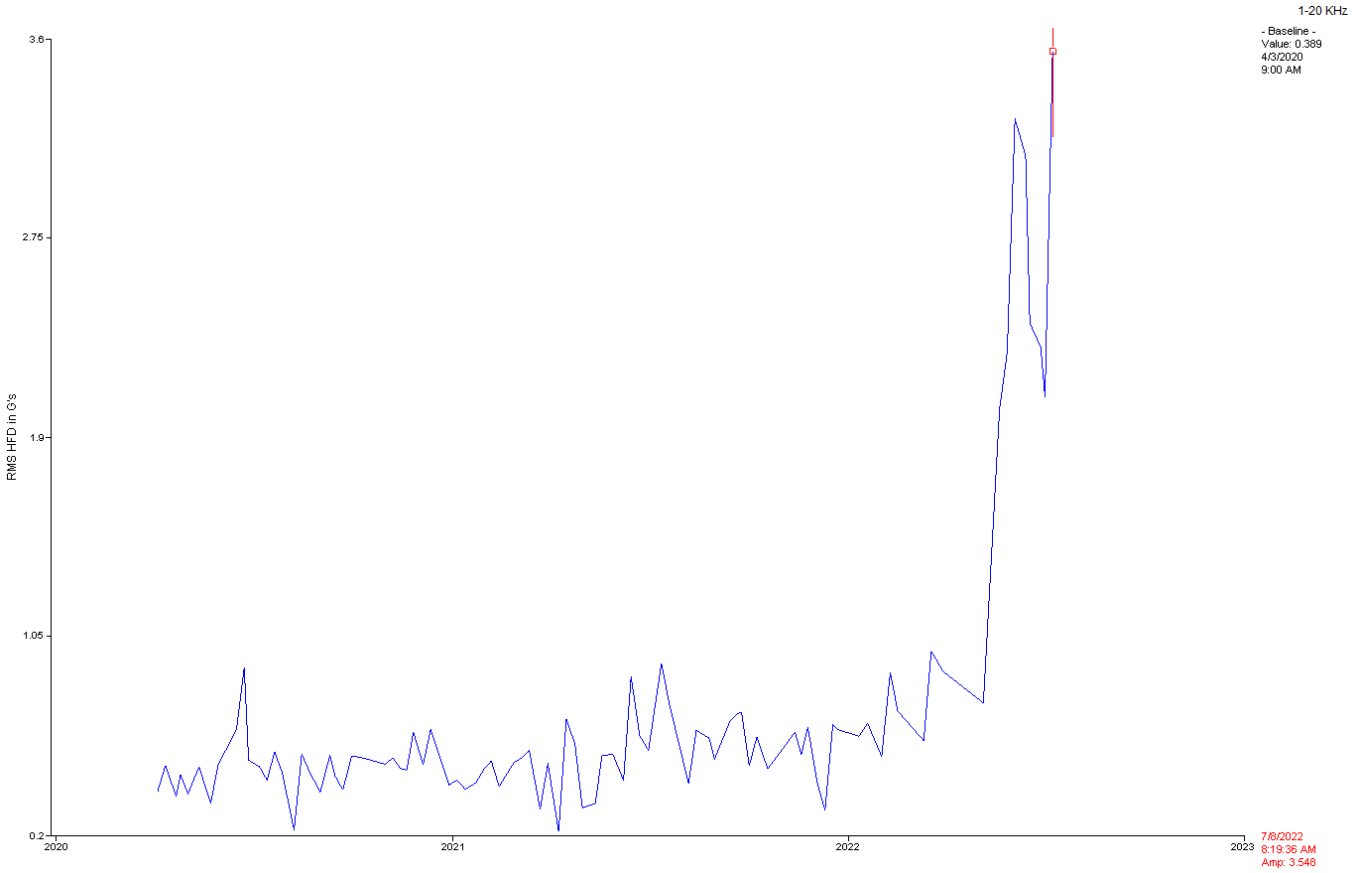
CLASS II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

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

Defect Summary

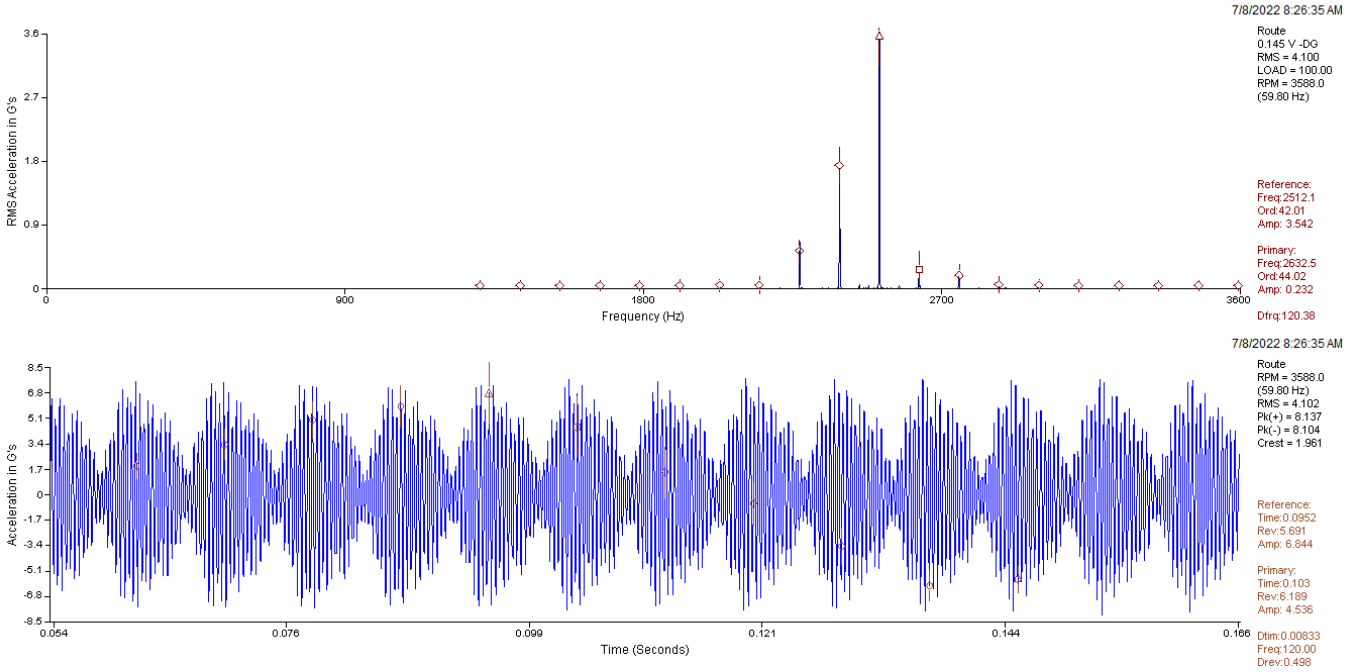
A/B Concentrator Vacuum Pump CLASS II



Observation:
1-20 kHz. trend data of POH shows an increase in high frequency vibration amplitude.

Recommendation:
Pump has had elevated vane pass vibrations and high frequency non-synchronous peaks present in spectrum in the recent past. Process has a lot of influence on pump vibration, but pump bearings still appear to have defects according to the spectral data. Impeller and other pump internal components may also have wear. Pump may need some attention in the near months.

C 203 Compressor CLASS I



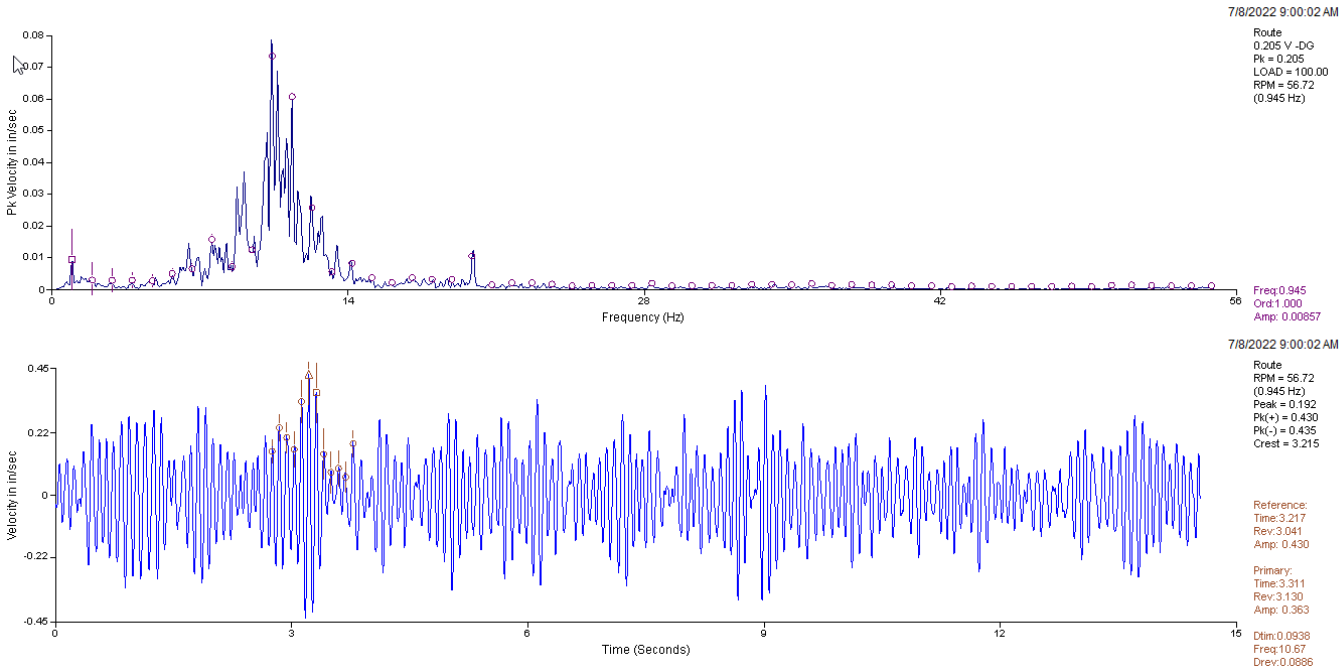
Observation:

Motor inboard axial data shows a high 1 x rotor bar pass frequency vibration with 120 Hz sidebands. Waveform shows a strong beat vibration with amplitude of 16 g's pk to pk. Beat frequency in waveform appears to be 120 Hz or 2 x line frequency.

Recommendation:

Motor data is back up and suggests that the rotor has heavy load. This vibration comes and goes based on load. For now, ensure compressor is operating under normal parameters.

D Hydrogenator Agitator CLASS II



Observation:

Motor axial is higher than normal. Gearbox does have physical torsional type movement and may be causing some of the motor axial vibration. Data shown is output top end of gearbox N-S direction. Dominant vibration is around 10 Hz with modulation around this peak. Gearbox has some vibration at a sub harmonic of motor 1 x rpm which may indicate some int. shaft and or output shaft gear wear.

Recommendation:

Ensure motor/gearbox does not have misalignment. Inspect couplings and drive shaft for issues. Gearbox also seemed to have excessive movement while taking data. This is causing excessive axial movement of the jack shaft and is causing motor axial vibration. Inspect structure/gearbox mounts for signs of fatigue, cracks, etc. Output shaft may be bowed or bent.

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 4: ARK WK 2

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
XSTORPMP - X STORAGE PUMP	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.066 In/Sec	.269 G-s
21 - MOTOR INBOARD HORIZONTAL	.093 In/Sec	.277 G-s
23 - MOTOR INBOARD AXIAL	.081 In/Sec	.241 G-s
71 - PUMP HORIZONTAL	.096 In/Sec	.138 G-s
72 - PUMP VERTICAL	.052 In/Sec	.172 G-s
YSTORPMP - Y STORAGE PUMP	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.144 In/Sec	.995 G-s
21 - MOTOR INBOARD HORIZONTAL	.143 In/Sec	1.006 G-s
23 - MOTOR INBOARD AXIAL	.084 In/Sec	.168 G-s
71 - PUMP HORIZONTAL	.098 In/Sec	.340 G-s
72 - PUMP VERTICAL	.046 In/Sec	.322 G-s
RSTORPMP - R STORAGE PUMP	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.047 In/Sec	.614 G-s
21 - MOTOR INBOARD HORIZONTAL	.035 In/Sec	.925 G-s
23 - MOTOR INBOARD AXIAL	.108 In/Sec	.297 G-s
71 - PUMP HORIZONTAL	.044 In/Sec	.193 G-s
72 - PUMP VERTICAL	.027 In/Sec	.346 G-s
2130-1old - C Concentrator Vacuum Pump	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.056 In/Sec	.431 G-s
21 - Motor IB HOR	.068 In/Sec	.677 G-s
23 - Motor IB AXIAL	.178 In/Sec	.174 G-s
71 - Compressor IB HOR	.105 In/Sec	.857 G-s
81 - Compressor OB Horiz	.156 In/Sec	.403 G-s
83 - Compressor OB Axial	.109 In/Sec	1.625 G-s
7000-01 - AGITATOR,HYDROGENATOR C	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHZ
02 - DRIVESHAFT BRG-EAST-WEST	.044 In/Sec	.282 G-s
03 - DRIVESHAFT BRG-VERTICAL	.050 In/Sec	.304 G-s
11 - C Hydro Agitator MOTOR OB HORIZ	.067 In/Sec	1.045 G-s
12 - C Hydro Agitator MOTOR OB VERT	.067 In/Sec	.708 G-s
13 - C Hydro Agitator Motor OB Axial	.094 In/Sec	.578 G-s
21 - C Hydro Agitator MOTOR IB HORIZ	.072 In/Sec	.767 G-s
22 - C Hydro Agitator MOTOR IB VERT	.094 In/Sec	1.071 G-s
23 - C Hydro Agitator Motor IB Axial	.068 In/Sec	.706 G-s
31 - C Hydro Agitator GrBx In Horizon	.063 In/Sec	.280 G-s
32 - C Hydro Agitator GrBx In VERT	.064 In/Sec	.463 G-s
33 - C Hydro Agitator GrBx In Axial	.042 In/Sec	.302 G-s
41 - C HY AG GBX INPUT OUTBOARD HZ	.047 In/Sec	.579 G-s
42 - C HY AG GBX INPUT OUTBOARD VERT	.054 In/Sec	.425 G-s
51 - C Hydro GrBx shaft 2 Top HZ E-W	.053 In/Sec	.138 G-s
53 - C Hydro GrBx shaft 2 Top AXIAL	.141 In/Sec	.157 G-s
61 - C Hydro GrBx shaft 2 BOT HZ E-W	.035 In/Sec	.210 G-s
71 - C Hydro GrBx OUTPUT TOP HZ E-W	.054 In/Sec	.208 G-s
81 - C Hydro GrBx OUTPUT BOT HZ E-W	.021 In/Sec	.163 G-s
83 - C Hydro GrBx OUTPUT Top Axial	.045 In/Sec	.288 G-s
57 - A/B Concentr Vac Pmp-var RPM	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.186 In/Sec	.461 G-s
12 - Motor OB VERT	.074 In/Sec	.555 G-s
21 - Motor IB HOR	.176 In/Sec	.982 G-s

23 - Motor IB AXIAL	.060 In/Sec	.764 G-s
71 - Compressor IB HOR	.197 In/Sec	.942 G-s
81 - Compressor OB Horiz	.193 In/Sec	5.016 G-s
83 - Compressor OB Axial	.051 In/Sec	3.464 G-s

2130-1 - FLASH VAP VAC PUMP-var speed (08-Jul-22)

	OVERALL LEVEL	1-20 KHz
11 - Motor OB HOR	.046 In/Sec	.505 G-s
12 - Motor OB VERT	.035 In/Sec	.421 G-s
21 - Motor IB HOR	.042 In/Sec	.623 G-s
22 - Motor IB VERT	.041 In/Sec	.439 G-s
23 - Motor IB AXIAL	.062 In/Sec	.283 G-s
71 - Compressor IB HOR	.062 In/Sec	.241 G-s
72 - Compressor IB VERT	.047 In/Sec	.127 G-s
81 - Compressor OB Horiz	.063 In/Sec	.820 G-s
82 - Compressor OB VERT	.068 In/Sec	1.476 G-s
83 - Compressor OB Axial	.041 In/Sec	.509 G-s

C-203 - C-203 Comp (08-Jul-22)

	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.032 In/Sec	.857 G-s
12 - MOTOR OB VERT	.062 In/Sec	2.021 G-s
21 - MOTOR IB HOR	.106 In/Sec	4.599 G-s
22 - MOTOR IB VERT	.022 In/Sec	.523 G-s
23 - MOTOR IB AXIAL	.145 In/Sec	4.808 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.047 In/Sec	2.486 G-s
72M - COMP MALE SHAFT IB VERT	.051 In/Sec	2.863 G-s
73M - COMP MALE SHAFT IB AXIAL	.045 In/Sec	2.098 G-s
81M - COMP MALE SHAFT OB HOR	.036 In/Sec	6.436 G-s
82M - COMP MALE SHAFT OB VERT	.053 In/Sec	6.611 G-s
71F - COMP FEMALE SHAFT IB HOR	.038 In/Sec	1.906 G-s
72F - COMP FEMALE SHAFT IB VERT	.042 In/Sec	1.071 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.085 In/Sec	3.973 G-s
81F - COMP FEMALE SHAFT OB HOR	.031 In/Sec	2.188 G-s
82F - COMP FEMALE SHAFT OB VERT	.039 In/Sec	1.735 G-s

C-202 - C-202 Comp (08-Jul-22)

	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.048 In/Sec	1.530 G-s
12 - MOTOR OB VERT	.107 In/Sec	.565 G-s
21 - MOTOR IB HOR	.063 In/Sec	.311 G-s
22 - MOTOR IB VERT	.063 In/Sec	.151 G-s
23 - MOTOR IB AXIAL	.053 In/Sec	.989 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.037 In/Sec	2.209 G-s
72M - COMP MALE SHAFT IB VERT	.055 In/Sec	3.164 G-s
73M - COMP MALE SHAFT IB AXIAL	.063 In/Sec	2.598 G-s
81M - COMP MALE SHAFT OB HOR	.034 In/Sec	7.192 G-s
82M - COMP MALE SHAFT OB VERT	.065 In/Sec	2.177 G-s
71F - COMP FEMALE SHAFT IB HOR	.027 In/Sec	2.539 G-s
72F - COMP FEMALE SHAFT IB VERT	.066 In/Sec	2.452 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.084 In/Sec	3.367 G-s
81F - COMP FEMALE SHAFT OB HOR	.032 In/Sec	3.307 G-s
82F - COMP FEMALE SHAFT OB VERT	.053 In/Sec	2.003 G-s

C-201 - C-201 Comp (08-Jul-22)

	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.103 In/Sec	2.153 G-s
12 - MOTOR OB VERT	.098 In/Sec	2.094 G-s
21 - MOTOR IB HOR	.093 In/Sec	.279 G-s
22 - MOTOR IB VERT	.038 In/Sec	.062 G-s
23 - MOTOR IB AXIAL	.059 In/Sec	1.685 G-s
	OVERALL LEVEL	1-20 KHZ
71M - COMP MALE SHAFT IB HOR	.056 In/Sec	3.478 G-s
72M - COMP MALE SHAFT IB VERT	.046 In/Sec	2.121 G-s
73M - COMP MALE SHAFT IB AXIAL	.066 In/Sec	2.021 G-s
81M - COMP MALE SHAFT OB HOR	.041 In/Sec	9.544 G-s
82M - COMP MALE SHAFT OB VERT	.057 In/Sec	5.241 G-s
71F - COMP FEMALE SHAFT IB HOR	.034 In/Sec	5.688 G-s

72F - COMP FEMALE SHAFT IB VERT	.047 In/Sec	3.188 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.094 In/Sec	4.381 G-s
81F - COMP FEMALE SHAFT OB HOR	.036 In/Sec	9.343 G-s
82F - COMP FEMALE SHAFT OB VERT	.056 In/Sec	13.31 G-s

new AC - INSTRUMENT AIR COMPRESSOR	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OB HOR	.121 In/Sec	1.360 G-s
12 - MOTOR OB VERT	.096 In/Sec	1.242 G-s
13 - MOTOR OB AXIAL	.054 In/Sec	.621 G-s
21 - MOTOR IB HOR	.097 In/Sec	1.614 G-s
22 - MOTOR IB VERT	.062 In/Sec	.813 G-s
23 - MOTOR IB AXIAL	.041 In/Sec	.826 G-s
	OVERALL LEVEL	1-20 KHZ
71F - COMP FEMALE SHAFT IB HOR	.248 In/Sec	9.782 G-s
72F - COMP FEMALE SHAFT IB VERT	.149 In/Sec	4.565 G-s
73F - COMP FEMALE SHAFT IB AXIAL	.150 In/Sec	5.056 G-s
81F - COMP FEMALE SHAFT OB HOR	.125 In/Sec	2.678 G-s
82F - COMP FEMALE SHAFT OB VERT	.338 In/Sec	5.749 G-s
83F - COMP FEMALE SHAFT OB AXIAL	.179 In/Sec	4.503 G-s
71M - COMP MALE SHAFT IB HOR	.201 In/Sec	7.323 G-s
72M - COMP MALE SHAFT IB VERT	.285 In/Sec	11.09 G-s
73M - COMP MALE SHAFT IB AXIAL	.150 In/Sec	8.209 G-s
81M - COMP MALE SHAFT OB HOR	.147 In/Sec	4.201 G-s
82M - COMP MALE SHAFT OB VERT	.329 In/Sec	4.779 G-s
83M - COMP MALE SHAFT OB AXIAL	.237 In/Sec	5.829 G-s

201-08A - COMPRESSOR,NASH A 201-08A	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - Nash Compr A Motor OB Horiz	.047 In/Sec	.106 G-s
12 - Nash Compr A Motor OB Vertical	.057 In/Sec	.097 G-s
13 - Nash Compr A Motor OB Axial	.128 In/Sec	.098 G-s
21 - Nash Compr A Motor IB Horiz	.045 In/Sec	.079 G-s
22 - Nash Compr A Motor IB VERT	.048 In/Sec	.071 G-s
23 - Nash Compr A Motor IB AXIAL	.075 In/Sec	.096 G-s
71 - Nash Compr A COMP IB HORIZ	.144 In/Sec	.405 G-s
72 - Nash Compr A Compressor IB Verti	.157 In/Sec	.284 G-s
73 - Nash Compr A COMP IB AXIAL	.129 In/Sec	.216 G-s
81 - Nash Compr A COMP OB HORIZ	.153 In/Sec	.183 G-s
82 - Nash Compr A Compressor OB Verti	.191 In/Sec	.227 G-s
83 - Nash Compr A Compressor OB Axial	.131 In/Sec	.094 G-s

202-05 - NASH SEAL LIQUID PUMP-A	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZ	.015 In/Sec	.089 G-s
21 - MOTOR INBOARD HORIZ	.015 In/Sec	.179 G-s
23 - MOTOR INBOARD AXIAL	.021 In/Sec	.377 G-s
71 - PUMP HORIZ	.017 In/Sec	.054 G-s
72 - PUMP VERT	.012 In/Sec	.049 G-s

9002-10 - D-HYDROGENATOR AGITATOR	(08-Jul-22)	
	OVERALL LEVEL	1-20 KHz
11 - MOTOR OUTBOARD HORIZONTAL	.086 In/Sec	.220 G-s
21 - MOTOR INBOARD HORIZONTAL	.070 In/Sec	.156 G-s
23 - MOTOR INBOARD AXIAL	.278 In/Sec	.140 G-s
	OVERALL LEVEL	1-20 KHZ
31 - GEARBOX INPUT SHAFT -HORIZONTAL	.158 In/Sec	.690 G-s
31L - GEARBOX INPUT SHAFT-N-S-LOW FRQ	.196 In/Sec	.129 G-s
	OVERALL LEVEL	1-20 KHz
51 - GEARBOX OUTPUT TOP E-W	.168 In/Sec	.222 G-s
51L - GEARBOX OUTPUT TOP E-W- 100RPM	.205 In/Sec	.190 G-s
52 - GEARBOX TOP PLATE- N-S	.239 In/Sec	.315 G-s
52L - GEARBOX OUTPUT TOP N-S 100RPM	.243 In/Sec	.292 G-s
53 - GEARBOX OUTPUT TOP -AXIAL	.061 In/Sec	.473 G-s
53L - GEARBOX OUTPUT TOP AXIAL 100RPM	.021 In/Sec	.529 G-s
61 - GEARBOX OUTPUT BOTTOM E-W-HZ	.179 In/Sec	.310 G-s
61L - GEARBOX OUTPUT BOTTOM-E-W 100RPM	.194 In/Sec	.289 G-s
81 - AGIT INTERMED BRG @ SEAL- N-S	.194 In/Sec	.245 G-s
82 - AGIT INTERMED BRG @ SEAL- E-W	.249 In/Sec	.240 G-s
83 - AGIT INTERMED BRG @ SEAL- VERT	.022 In/Sec	.396 G-s

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9003-01     - D-HYDRO PRIMARY FILT FD PUMP   (08-Jul-22)
                                              OVERALL LEVEL     1-20 KHz
11   - MOTOR OUTBOARD HORIZONTAL               .053 In/Sec       .356 G-s
21   - MOTOR INBOARD HORIZONTAL                .046 In/Sec       .536 G-s
23   - MOTOR INBOARD AXIAL                     .039 In/Sec       .632 G-s
71   - PUMP HORIZONTAL                         .054 In/Sec       .378 G-s
72   - PUMP VERTICAL                           .069 In/Sec       .294 G-s

9001-01     - D-HYDRO SECOND. FILT FD PUMP   (08-Jul-22)
                                              OVERALL LEVEL     1-20 KHz
11   - MOTOR OUTBOARD HORIZONTAL               .046 In/Sec       .500 G-s
21   - MOTOR INBOARD HORIZONTAL                .051 In/Sec       .560 G-s
23   - MOTOR INBOARD AXIAL                     .067 In/Sec       .690 G-s
71   - PUMP HORIZONTAL                         .062 In/Sec       .389 G-s
72   - PUMP VERTICAL                           .056 In/Sec       .456 G-s

191-07      - M MIX BED WATER PUMP 191-07    (08-Jul-22)
                                              OVERALL LEVEL     1-20 KHz
11   - Chilled H2O Pump Motor OB Horizo        .082 In/Sec       .276 G-s
21   - Chilled H2O Pump Motor IB Horizo        .055 In/Sec       .469 G-s
23   - MOTOR INBOARD                           .059 In/Sec       .533 G-s
71   - Chilled H2O Pump IB Horizontal          .253 In/Sec       .237 G-s
72   - PUMP VERTICAL                           .167 In/Sec       .271 G-s

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   Clarification Of Vibration Units:
      Acc       -->  G-s       PK
      Vel       -->  In/Sec    PK
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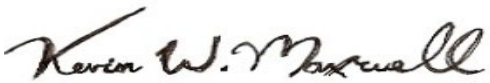
As always, it has been a pleasure to serve Arkema. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

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