HI-SPEED INDUSTRIAL SERVICE

MILLINGTON, TN

December 3, 2021

Arkema

Subject: November 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.

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
Senior Reliability Specialists
Hi-Speed Industrial Service
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H2O2 Weekly Route Critical Equipment Observations

C Concentrator Vacuum Pump 2130-1
The motor has the highest vibration amplitude of about 0.19"/second velocity peak overall in the outboard 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 still shows a low amplitude 3x RPM vibration in the motor drive end measurements. This usually indicates some misalignment. Adjust only as time allows. **Rated a Class I Defect.**

A/B Concentrator Vacuum Pump 57
The unit vibration overall is 0.32"/sec peak velocity for the outboard pump bearing and is dominated by a possible vane pass. We will continue to watch for changes. **Rated a Class I Defect.**

Flash Vacuum Pump 2130-1
Data shows all vibrations are under 0.1"/second velocity peak overall. No issues of note.

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 5.4 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 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 6.2 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 5.9 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 11 g's RMS overall acceleration. Harmonics of 4.3X and 6.9X input speed are evident in the data. The dominant vibration appears to be at near 2500 Hz and is a 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 0.21"/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. **Rated a Class I Defect.**

D Hydrogenator Agitator 9002
Highest overall vibration is at 0.24"/sec velocity peak for the gearbox output top N/S. 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.**

H2O2 Monthly Route Equipment

North Cooling Tower South Fan
The motor vibration has increased to 0.5"/second at 1x motor RPM. Inspect for coupling, alignment, and fastener issues. **Rated a Class II Defect.**

H2 Monthly Route Equipment

East Cooling Tower Pump
The pump still shows an elevated shaft speed vibration. Inspect the coupling, alignment, and all fasteners. **Rated a Class II Defect.**

FD Blower C2
The fan motor still has an elevated shaft speed vibration but has dropped a little since last survey. Inspect the motor cooling fan, shaft coupling, alignment, structure, and all fasteners. **Rated a Class II Defect.**

PUMP MEA CIRC EAST P2B
The motor and pump bearing acceleration is elevated and could indicate early distress in the bearings. Ensure the bearings are lubricated if applicable. **Rated a Class II Defect.**

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Route No. 6: ARKEMA WK4
Report Date: 03-Dec-21 13:14

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
2130-1old - C Concentrator Vacuum Pump (03-Dec-21)			
	OVERALL LEVEL	1-20 KHz	
11	.059 In/Sec	.431 G-s	1200.0 RPM
21	.059 In/Sec	.488 G-s	
23	.191 In/Sec	.172 G-s	
71	.161 In/Sec	.775 G-s	
81	.176 In/Sec	.700 G-s	
83	.104 In/Sec	1.780 G-s	
7000-01 - AGITATOR,HYDROGENATOR C (03-Dec-21)			
	OVERALL LEVEL	1-20 KHZ	
02	.041 In/Sec	.027 G-s	45.00 RPM
03	.047 In/Sec	.036 G-s	
11	.084 In/Sec	.724 G-s	1400.0 RPM
12	.075 In/Sec	.637 G-s	
13	.112 In/Sec	.266 G-s	
21	.100 In/Sec	.173 G-s	
22	.133 In/Sec	.121 G-s	
23	.132 In/Sec	1.115 G-s	
31	.075 In/Sec	.427 G-s	
32	.075 In/Sec	.506 G-s	
33	.043 In/Sec	.171 G-s	
41	.070 In/Sec	.541 G-s	
42	.075 In/Sec	.519 G-s	
51	.061 In/Sec	.379 G-s	375.0 RPM
53	.082 In/Sec	.208 G-s	
61	.035 In/Sec	.214 G-s	
71	.050 In/Sec	.248 G-s	45.00 RPM
81	.023 In/Sec	.164 G-s	
83	.053 In/Sec	.219 G-s	
57 - A/B Concentr Vac Pmp-var RPM (03-Dec-21)			
	OVERALL LEVEL	1-20 KHz	
11	.066 In/Sec	.320 G-s	900.0 RPM
12	.057 In/Sec	.395 G-s	
21	.078 In/Sec	.090 G-s	
23	.082 In/Sec	.213 G-s	
71	.130 In/Sec	.759 G-s	
81	.325 In/Sec	.595 G-s	
83	.049 In/Sec	.781 G-s	
2130-1 - FLASH VAP VAC PUMP-var speed (03-Dec-21)			
	OVERALL LEVEL	1-20 KHz	
11	.050 In/Sec	.171 G-s	1200.0 RPM
12	.033 In/Sec	.236 G-s	

21	.043 In/Sec	.423 G-s	
22	.045 In/Sec	.186 G-s	
23	.054 In/Sec	.375 G-s	
71	.064 In/Sec	.265 G-s	
72	.074 In/Sec	.752 G-s	
81	.084 In/Sec	.230 G-s	
82	.042 In/Sec	.664 G-s	
83	.041 In/Sec	.647 G-s	

C-203 - C-203 Comp (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.044 In/Sec	1.635 G-s	3588.0 RPM
12	.138 In/Sec	5.454 G-s	
21	.041 In/Sec	1.587 G-s	
22	.067 In/Sec	2.281 G-s	
23	.041 In/Sec	1.478 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.041 In/Sec	1.524 G-s	
72M	.045 In/Sec	1.697 G-s	
73M	.069 In/Sec	4.700 G-s	
81M	.066 In/Sec	5.960 G-s	
82M	.061 In/Sec	5.662 G-s	
71F	.039 In/Sec	1.255 G-s	
72F	.046 In/Sec	1.339 G-s	
73F	.086 In/Sec	3.832 G-s	
81F	.037 In/Sec	1.398 G-s	
82F	.038 In/Sec	.421 G-s	

C-202 - C-202 Comp (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.130 In/Sec	5.321 G-s	3588.0 RPM
12	.113 In/Sec	.472 G-s	
21	.055 In/Sec	.335 G-s	
22	.072 In/Sec	.654 G-s	
23	.063 In/Sec	1.807 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.039 In/Sec	2.717 G-s	
72M	.043 In/Sec	.938 G-s	
73M	.068 In/Sec	3.000 G-s	
81M	.040 In/Sec	5.956 G-s	
82M	.059 In/Sec	4.212 G-s	
71F	.029 In/Sec	6.206 G-s	
72F	.060 In/Sec	1.297 G-s	
73F	.072 In/Sec	4.424 G-s	
81F	.034 In/Sec	2.066 G-s	
82F	.050 In/Sec	1.499 G-s	

C-201 - C-201 Comp (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.118 In/Sec	3.267 G-s	3588.0 RPM
12	.088 In/Sec	1.409 G-s	
21	.091 In/Sec	1.223 G-s	
22	.043 In/Sec	1.178 G-s	
23	.119 In/Sec	4.009 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.039 In/Sec	1.636 G-s	
72M	.049 In/Sec	2.176 G-s	

73M	.075 In/Sec	1.755 G-s	
81M	.094 In/Sec	5.154 G-s	
82M	.053 In/Sec	5.461 G-s	
71F	.045 In/Sec	2.621 G-s	
72F	.053 In/Sec	1.650 G-s	
73F	.053 In/Sec	1.747 G-s	
81F	.057 In/Sec	2.718 G-s	
82F	.050 In/Sec	1.378 G-s	

new AC - INSTRUMENT AIR COMPRESSOR (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.144 In/Sec	.804 G-s	1780.0 RPM
12	.106 In/Sec	.711 G-s	
13	.058 In/Sec	.469 G-s	
21	.147 In/Sec	1.649 G-s	
22	.086 In/Sec	.754 G-s	
23	.049 In/Sec	.798 G-s	
	OVERALL LEVEL	1-20 KHZ	
71M	.197 In/Sec	7.582 G-s	
72M	.199 In/Sec	6.939 G-s	
73M	.163 In/Sec	4.658 G-s	
81M	.131 In/Sec	2.815 G-s	
82M	.328 In/Sec	7.734 G-s	
83M	.146 In/Sec	3.515 G-s	
71F	.095 In/Sec	3.902 G-s	
72F	.242 In/Sec	11.63 G-s	
73F	.121 In/Sec	5.833 G-s	
81F	.245 In/Sec	8.956 G-s	
82F	.213 In/Sec	6.867 G-s	
83F	.208 In/Sec	4.089 G-s	

201-08A - COMPRESSOR,NASH A 201-08A (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.065 In/Sec	.113 G-s	506.3 RPM
12	.058 In/Sec	.147 G-s	
13	.105 In/Sec	.065 G-s	
21	.055 In/Sec	.071 G-s	
22	.066 In/Sec	.156 G-s	
23	.091 In/Sec	.090 G-s	
71	.116 In/Sec	1.229 G-s	
72	.171 In/Sec	.963 G-s	
73	.080 In/Sec	.117 G-s	
81	.119 In/Sec	.471 G-s	
82	.210 In/Sec	.245 G-s	
83	.120 In/Sec	.258 G-s	

202-05 - NASH SEAL LIQUID PUMP-A (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.021 In/Sec	.132 G-s	1800.0 RPM
21	.013 In/Sec	.226 G-s	
23	.016 In/Sec	.117 G-s	
71	.022 In/Sec	.045 G-s	
72	.014 In/Sec	.040 G-s	

9002-10 - D-HYDROGENATOR AGITATOR (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.088 In/Sec	.062 G-s	1185.0 RPM

21	.067 In/Sec	.091 G-s	
23	.053 In/Sec	.062 G-s	
	OVERALL LEVEL	1-20 KHZ	
31	.173 In/Sec	.749 G-s	
31L	.139 In/Sec	.733 G-s	
	OVERALL LEVEL	1-20 KHz	
51	.144 In/Sec	.216 G-s	
51L	.199 In/Sec	.245 G-s	100.0 RPM
52	.187 In/Sec	.221 G-s	
52L	.235 In/Sec	.221 G-s	
53	.085 In/Sec	.373 G-s	
53L	.024 In/Sec	.370 G-s	
61	.121 In/Sec	.150 G-s	
61L	.155 In/Sec	.136 G-s	
81	.033 In/Sec	.036 G-s	
82	.034 In/Sec	.031 G-s	
83	.022 In/Sec	.039 G-s	

Clarification Of Vibration Units:
Acc --> G-s PK
Vel --> In/Sec PK

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Report Date: 03-Dec-21 13:15

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
NTC-SF - N CT-SOUTH FAN, N TWR	(03-Dec-21)		
	OVERALL LEVEL	1-20 KHz	
1	.535 In/Sec	.544 G-s	1780.0 RPM
2	.337 In/Sec	.505 G-s	
3	.198 In/Sec	.534 G-s	
	OVERALL LEVEL	1-20 KHZ	
4	.214 In/Sec	.423 G-s	
5	.0033 In/Sec	.0011 G-s	
6	.344 In/Sec	.383 G-s	
6L	.338 In/Sec	.421 G-s	

Clarification Of Vibration Units:
Acc --> G-s PK
Vel --> In/Sec PK

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Report Date: 03-Dec-21 13:15

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED

NCT - NF	- N CT -NORTH FAN, N TWR	(03-Dec-21)		
		OVERALL LEVEL	1-20 KHz	
	7	.217 In/Sec	.447 G-s	1780.0 RPM
	8	.231 In/Sec	.385 G-s	
	9	.134 In/Sec	.319 G-s	
		OVERALL LEVEL	1-20 KHZ	
	10	.114 In/Sec	.295 G-s	
	11	.117 In/Sec	.273 G-s	
	12	.114 In/Sec	.355 G-s	

Clarification Of Vibration Units:
Acc --> G-s PK
Vel --> In/Sec PK

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Report Date: 03-Dec-21 13:16

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
STC-NF	- S CT - NORTH FAN, S TWR (03-Dec-21)		
	OVERALL LEVEL	1-20 KHz	
1	.285 In/Sec	.511 G-s	1780.0 RPM
2	.246 In/Sec	.241 G-s	
3	.224 In/Sec	.077 G-s	
	OVERALL LEVEL	1-20 KHZ	
5	.128 In/Sec	.481 G-s	
* 6	.175 In/Sec	.481 G-s	
4	.136 In/Sec	.347 G-s	

Clarification Of Vibration Units:
Acc --> G-s PK
Vel --> In/Sec PK

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

Abbreviated Last Measurement Summary

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Database: Arkema.rbm
Station: PEROXIDE
Report Date: 03-Dec-21 13:16

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	MACHINE SPEED
STC-MF	- S CT - MID FAN, S TWR (03-Dec-21)		
	OVERALL LEVEL	1-20 KHz	
1	.300 In/Sec	.429 G-s	1780.0 RPM
2	.229 In/Sec	.202 G-s	
3	.121 In/Sec	.107 G-s	
	OVERALL LEVEL	1-20 KHZ	
5	.116 In/Sec	.427 G-s	

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       6                .071 In/Sec       .510 G-s
       4                .098 In/Sec       .264 G-s

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   Clarification Of Vibration Units:
      Acc      -->  G-s      PK
      Vel      -->  In/Sec   PK                        Abbreviated Last Measurement
Summary
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               Database:  Arkema.rbm
               Station:   PEROXIDE
               Report Date:  03-Dec-21   13:16

 MEASUREMENT POINT     OVERALL LEVEL       HFD / VHFD      MACHINE SPEED
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 STC-SF     - S CT - SOUTH FAN, S TWR       (03-Dec-21)
                        OVERALL LEVEL     1-20 KHz
       1                 .258 In/Sec       .351 G-s        1780.0 RPM
       2                 .288 In/Sec       .202 G-s
       3                 .391 In/Sec       .099 G-s
                        OVERALL LEVEL     1-20 KHZ
       5                 .096 In/Sec       .526 G-s
       6                 .290 In/Sec       .668 G-s
       4                 .166 In/Sec       .491 G-s

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   Clarification Of Vibration Units:
      Acc      -->  G-s      PK
      Vel      -->  In/Sec   PK                        Abbreviated Last Measurement
Summary
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               Database:  Arkema.rbm
               Station:   HYDROGEN
               Route No.  1:  H2 MONTHLY
               Report Date:  03-Dec-21   13:17

 MEASUREMENT POINT     OVERALL LEVEL       HFD / VHFD      MACHINE SPEED
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 P2B        - PUMP MEA CIRC EAST P2B        (03-Dec-21)
                        OVERALL LEVEL     1-20 KHz
       11                .056 In/Sec      2.642 G-s        3585.0 RPM
       21                .060 In/Sec      3.141 G-s
       23                .135 In/Sec      2.568 G-s
       71                .163 In/Sec      1.649 G-s
       72                .130 In/Sec      2.544 G-s

 P2A        - PUMP MEA CIRC WEST P2A        (30-Jun-21)
                        OVERALL LEVEL     1-20 KHz
       11                .088 In/Sec       .093 G-s        3585.0 RPM
       21                .057 In/Sec       .122 G-s
       23                .049 In/Sec       .076 G-s
       71                .211 In/Sec       .180 G-s
       72                .177 In/Sec       .469 G-s
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P1B - PUMP BFW EAST P1B (30-Aug-21)

	OVERALL LEVEL	1-20 KHz	
11	.056 In/Sec	.252 G-s	3600.0 RPM
21	.047 In/Sec	.721 G-s	
23	.041 In/Sec	.103 G-s	
71	.135 In/Sec	.165 G-s	
72	.122 In/Sec	.246 G-s	
81	.072 In/Sec	.213 G-s	
82	.072 In/Sec	.390 G-s	
83	.031 In/Sec	.948 G-s	

P1A - PUMP BFW WEST P1A (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.093 In/Sec	.566 G-s	3600.0 RPM
21	.124 In/Sec	1.170 G-s	
23	.266 In/Sec	.564 G-s	
71	.143 In/Sec	.753 G-s	
72	.139 In/Sec	.824 G-s	
81	.166 In/Sec	.729 G-s	
82	.157 In/Sec	.845 G-s	
83	.043 In/Sec	.872 G-s	

C2 - FD BLOWER C2 (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.411 In/Sec	.392 G-s	3600.0 RPM
21	.376 In/Sec	.922 G-s	
23	.249 In/Sec	.599 G-s	
71	.228 In/Sec	1.886 G-s	
81	.253 In/Sec	1.890 G-s	

C1 - ID -BLOWER C1 (03-Dec-21)

	OVERALL LEVEL	1-20 KHz	
11	.105 In/Sec	.125 G-s	1800.0 RPM
21	.113 In/Sec	.951 G-s	
23	.177 In/Sec	.605 G-s	
71	.115 In/Sec	.727 G-s	
72	.064 In/Sec	1.115 G-s	
81	.208 In/Sec	.670 G-s	
82	.210 In/Sec	1.054 G-s	

CTF-N - COOLING TOWER FAN - NORTH (22-Jan-18)

	OVERALL LEVEL	1-20 KHz	
11	.227 In/Sec	1.054 G-s	1780.0 RPM
12	.098 In/Sec	1.054 G-s	
13	.765 In/Sec	1.054 G-s	
21	.236 In/Sec	1.054 G-s	
22	.411 In/Sec	1.054 G-s	
23	.649 In/Sec	1.054 G-s	

CTF-S - COOLING TOWER FAN - SOUTH (22-Jan-18)

	OVERALL LEVEL	1-20 KHz	
11	.260 In/Sec	1.054 G-s	1780.0 RPM
12	.077 In/Sec	1.054 G-s	
13	.224 In/Sec	1.054 G-s	
21	.219 In/Sec	1.054 G-s	
22	.185 In/Sec	1.054 G-s	

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       23               .258 In/Sec      1.054 G-s

 CTPE       - EAST COOLING TOWER PUMP       (03-Dec-21)
                       OVERALL LEVEL     1-20 KHz
       11               .258 In/Sec       .880 G-s        1750.0 RPM
       21               .078 In/Sec       .583 G-s
       23               .350 In/Sec       .406 G-s
       71               .147 In/Sec       .698 G-s
       72               .499 In/Sec       .721 G-s

 CTPW       - WEST COOLING TOWER PUMP       (03-Dec-21)
                       OVERALL LEVEL     1-20 KHz
       11               .106 In/Sec       .330 G-s        1750.0 RPM
       21               .083 In/Sec       .469 G-s
       23               .172 In/Sec       .371 G-s
       71               .166 In/Sec      1.119 G-s
       72               .145 In/Sec      1.199 G-s

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  Clarification Of Vibration Units:
     Acc      -->  G-s      PK
     Vel      -->  In/Sec   PK
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