



Expertise Report

Filter: Equipment name (+) \ Tree order (+)

Location	VILLAMOR\	
Designation		
Equipment	BOOSTER PUMP#1	
Designation		
Abbreviation	BP#1	
Serial No		
Model		
Periodicity (d)	Normal 60	Alarm 15
Previous Advice	Condition	Rotation Speed

Fixed speed



Date 15/11/2018 12:34:45	FAIR <i>Health is not acceptable for a long time service.</i>	Speed 19.8 Hz / 1185 rpm Author u1 System - Serial FALCON - 11407 Sensor Connector
Condition DfCnd		

Diagnosis & Recommendation

Parameters sheet

Diagnosis

Pump Cavitation

Good overall state for component 'Electric motor'.

Overall Vibration levels are tolerable at 2.79mm/s though there were minor pedestal looseness on Motor holding base bolts or Minor Misalignment that being reflected in FFT at Motor DE Vertical.

Fair state for the component 'Pump'.

Highest vibrations measured at Pump IB Bearing Vertical with Overall Velocity of 5.53mm/s and dominant peak at 1x Blade Passing Frequency (119.25Hz) caused by Pump Cavitation.

Recommendations

Cavitation to be corrected

Double check alignment conditions using Precision laser alignment tool.

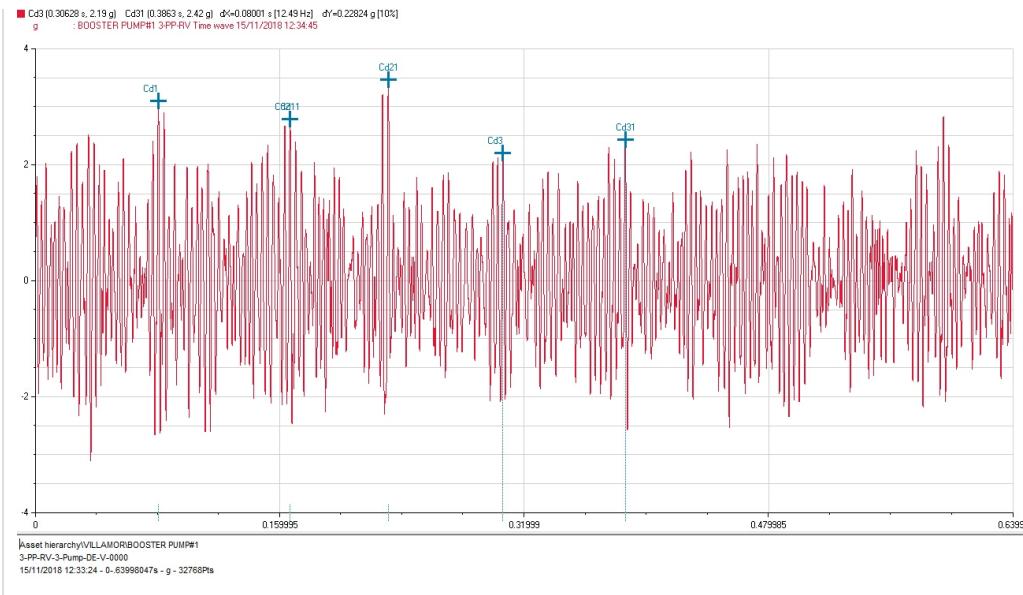
Cavitation to be corrected: process control and action as soon as possible. Follow the dynamic behavior of the pump to prevent impeller damage.

Location "3-Pump-DE" to be corrected

Location "4-Pump-NDE" to be watched

Continue monitor periodically to further trend the vibrations from pump cavitations.

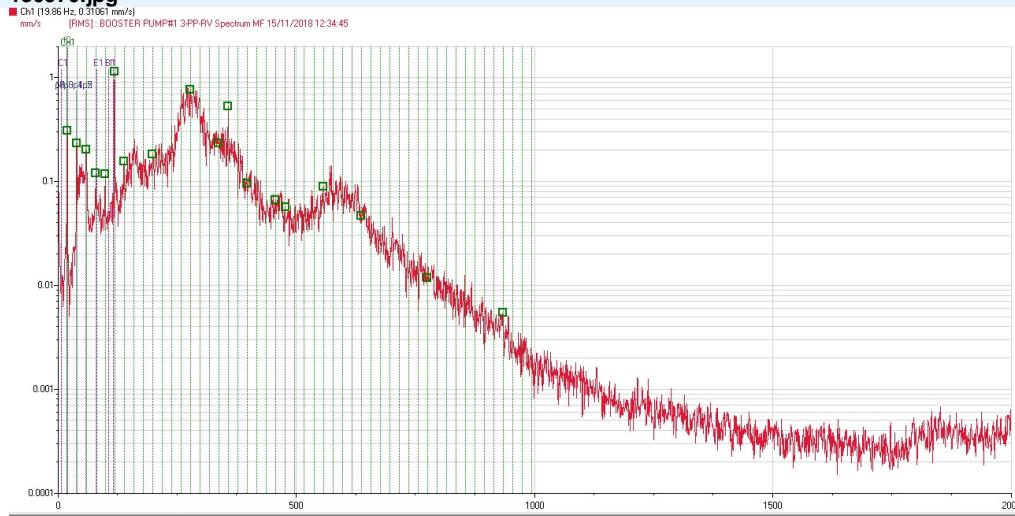
280aba.jpg



BOOSTER PUMP#1 3-PP-RV Time wave 15/1
Cd1 0.08062s
3.09g
0.16607s
2.79g
dx[0.08025s, 11.59Hz]
dy>0.3146g (-10.152%)
Cd2 0.16687s
2.78g
0.23117s
3.46g
dx[0.06429s, 15.55Hz]
dy>0.88373g (24.55%)
Cd3 0.08062s
2.19g
0.3883s
2.42g
dx[0.08001s, 12.49Hz]
dy>0.22824g (10.37%)

Non-periodic pulsation due to pump cavitations

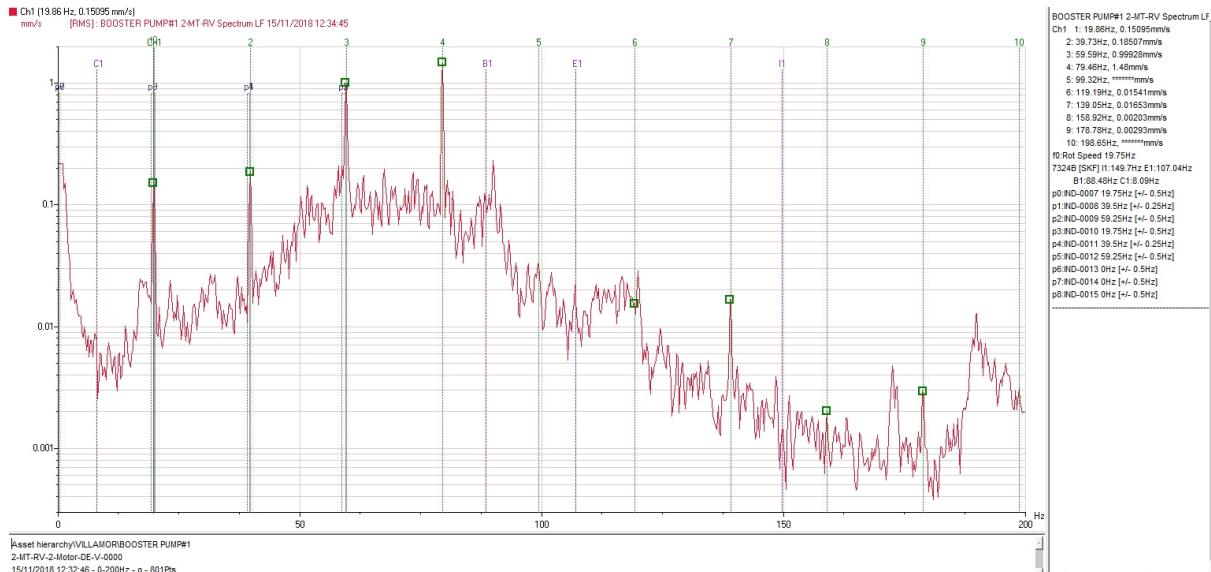
180970.jpg



BOOSTER PUMP#1 3-PP-RV Spectrum MF 15/1
Ch1: 1.19.98Hz, 0.31061mm/s
2: 39.59Hz, 0.2331mm/s
3: 59.59Hz, 0.2034mm/s
4: 79.46Hz, 0.1201mm/s
5: 99.33Hz, 0.1177mm/s
6: 119.19Hz, 1.14mm/s
7: 139.06Hz, 0.1566mm/s
8: 158.93Hz, 0.0935mm/s
9: 178.79Hz, *****mm/s
10: 198.66Hz, 0.18337mm/s
11: 218.52Hz, *****mm/s
12: 238.39Hz, *****mm/s
13: 258.26Hz, *****mm/s
14: 278.12Hz, 0.76764mm/s
15: 297.99Hz, *****mm/s
16: 317.85Hz, *****mm/s
17: 337.72Hz, 0.21187mm/s
18: 357.59Hz, 0.52973mm/s
19: 377.45Hz, *****mm/s
20: 397.32Hz, 0.09523mm/s
21: 417.19Hz, *****mm/s
22: 437.05Hz, *****mm/s
23: 456.92Hz, 0.06545mm/s
24: 476.78Hz, 0.05712mm/s
25: 496.65Hz, *****mm/s
26: 516.52Hz, *****mm/s
27: 536.39Hz, *****mm/s
28: 556.25Hz, 0.00935mm/s
29: 576.12Hz, *****mm/s
30: 595.99Hz, *****mm/s
31: 615.85Hz, *****mm/s
32: 635.71Hz, 0.04989mm/s
33: 655.58Hz, *****mm/s
34: 675.45Hz, *****mm/s
35: 695.31Hz, *****mm/s
36: 715.18Hz, *****mm/s
37: 735.05Hz, *****mm/s
38: 754.91Hz, *****mm/s
39: 774.78Hz, 0.01182mm/s
40: 794.65Hz, *****mm/s
41: 814.51Hz, *****mm/s
42: 834.38Hz, *****mm/s
43: 854.24Hz, *****mm/s
44: 874.11Hz, *****mm/s

FFT clearly shows haystack/humps or elevated base at high frequencies and 1x peak at Blade Passing Frequency - an indication of induced Pump Cavitations

b09a0.jpg



Pedestal Looseness at 1x, 2x, 3x, 4x peak

Location	VILLAMOR	
Designation		
Equipment	BOOSTER PUMP#2	
Designation		
Abbreviation	BP#2	
Serial No		
Model		
Periodicity (d)	Normal 60	Alarm 15
Previous Advice	Condition	Rotation Speed

Fixed speed



Date 15/11/2018 12:40:21	FAIR <i>Health is not acceptable for a long time service.</i>	Speed 19.8 Hz / 1185 rpm Author u1 System - Serial FALCON - 11407 Sensor Connector
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Diagnosis & Recommendation

Diagnosis

Pump Cavitation

Good overall state for component 'Electric motor'.

Fair state for the component 'Pump'.

Highest vibrations measured at Pump IB Bearing Vertical with Overall Velocity of 5.17mm/s and dominant peak at 1x Blade Passing Frequency (119.25Hz) caused by Pump Cavitation.

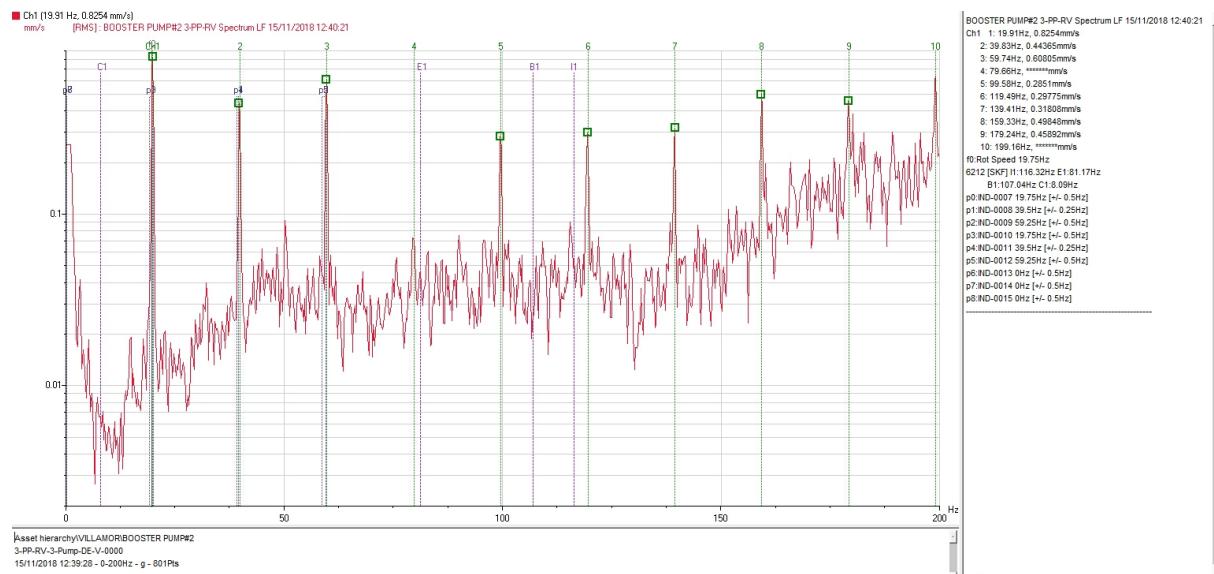
Parameters sheet

Recommendations

Cavitation to be corrected

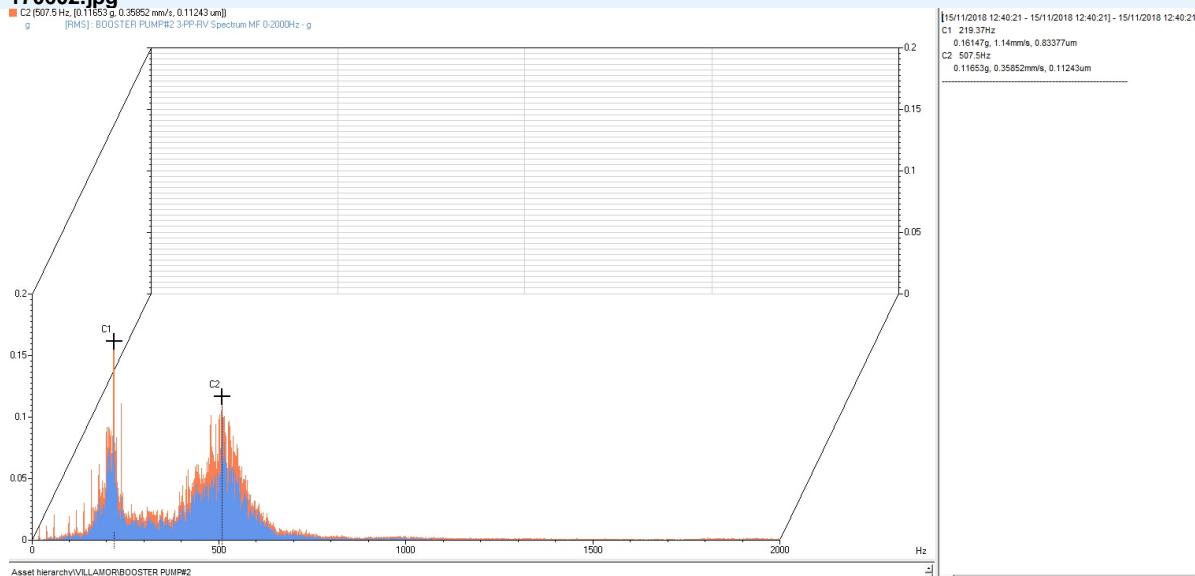
Cavitation to be corrected: process control and action as soon as possible. Follow the dynamic behavior of the pump to prevent impeller damage.

- Location "3-Pump-DE" to be corrected
- Location "4-Pump-NDE" to be watched



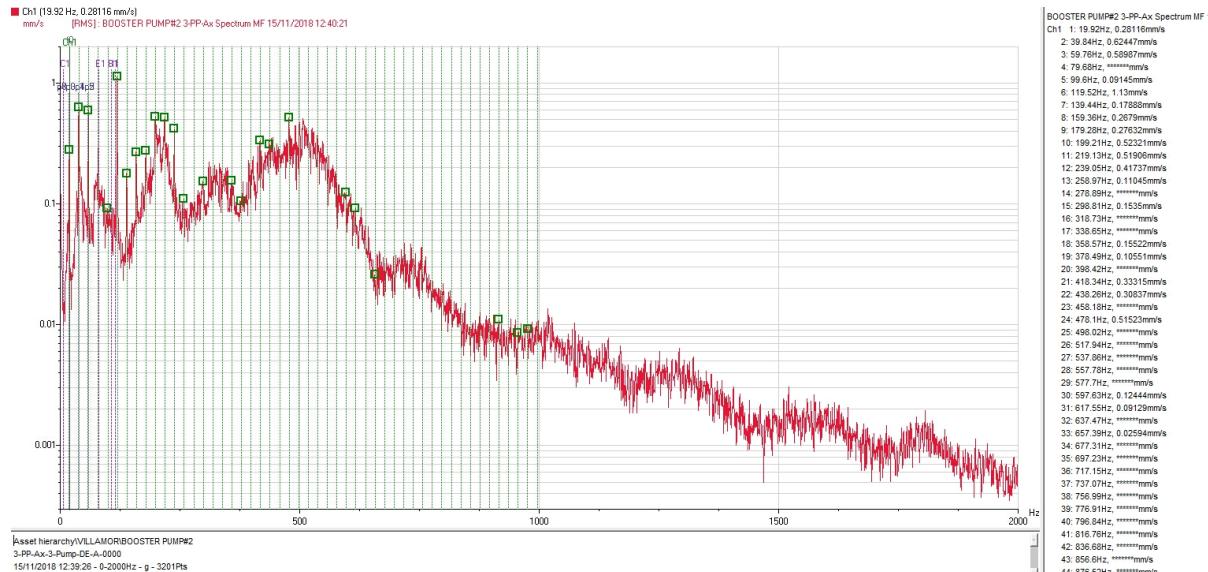
Highest vibrations measured at Pump IB Bearing Vertical with Overall Velocity of 5.17mm/s and dominant peak at 1x Blade Passing Frequency (119.25Hz) caused by Pump Cavitation.

170602.jpg



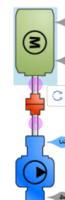
Elevated Base of Spectrum at high frequency range is an indication of Pump Cavitations

b0648.jpg



Location	WILLAMOR	
Designation		
Equipment	BOOSTER PUMP#4	
Designation		
Abbreviation	BP#4	
Serial No		
Model		
Periodicity (d)	Normal 60	Alarm 15
Previous Advice	Condition	Rotation Speed

Fixed speed



Date 15/11/2018 12:50:45	FAIR <i>Health is not acceptable for a long time service.</i>	Speed 19.9 Hz / 1194 rpm Author u1 System - Serial FALCON - 11407 Sensor Connector
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Diagnosis & Recommendation

Diagnosis

Pump Cavitations, Misalignment

Fair State for the component 'Electric motor'.

Highest vibrations measured Motor NDE Bearing Axial with Overall velocity of 4.16mm/s and dominant peak of 1x Motor RPM caused by Misalignment and alarmed Motor NDE Bearing Fault - Outer Race

Fair state for the component 'Pump'.

Highest vibrations measured at Pump IB Bearing Axial with Overall velocity of 5.76mm/s and dominant peak at 1x Motor RPM and 1x Blade passing Freq caused by Severe Pump Cavitations and Misalignment

Recommendations

Realign coupling, Recondition Pump

Realign motor and pump shaft or coupling using precision laser alignment tool.

Cavitation to be corrected: process control and action as soon as possible. Follow the dynamic behavior of the pump to prevent impeller damage.

Location "3-Pump-DE" to be corrected

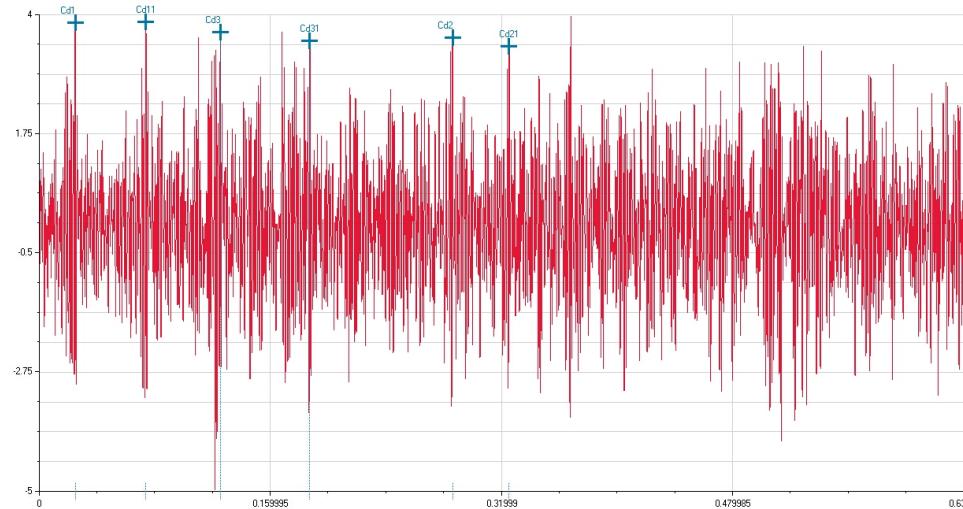
Location "4-Pump-NDE" to be corrected

Schedule Pump reconditioning to visualize Pump Impeller blades profile and pitch for damages. Check as well its wear ring clearances

50966.jpg

■ Cd3 [0.12548 g, 3.66 g] Cd31 [0.18751 g, 3.49 g] dY<0.05203 s [16.12 Hz] dY=-0.1707 g [-4%]

g : BOOSTER PUMP#4 3-PP-Ax Time wave 15/11/2018 12:50:45



BOOSTER PUMP#4 3-PP-Ax Time wave 15/11/2018 12:

Cd1 0.02509s

3.84g

0.07406s

3.85g

dY<0.04896s, 29.42Hz

dY>0.02979s (0.23329%)

Cd2 0.23826s

3.56g

0.32542s

3.4g

dX<0.03916s, 25.53Hz

dY>-0.1622g (-4.5508%)

Cd3 0.12548s

3.66g

0.10751s

3.49g

dX<0.05203s, 16.12Hz

dY>-0.1707g (-4.655%)

Asset hierarchy/VILLAMOR/BOOSTER PUMP#4

3-PP-Ax-3-Pump-DE-A-0000

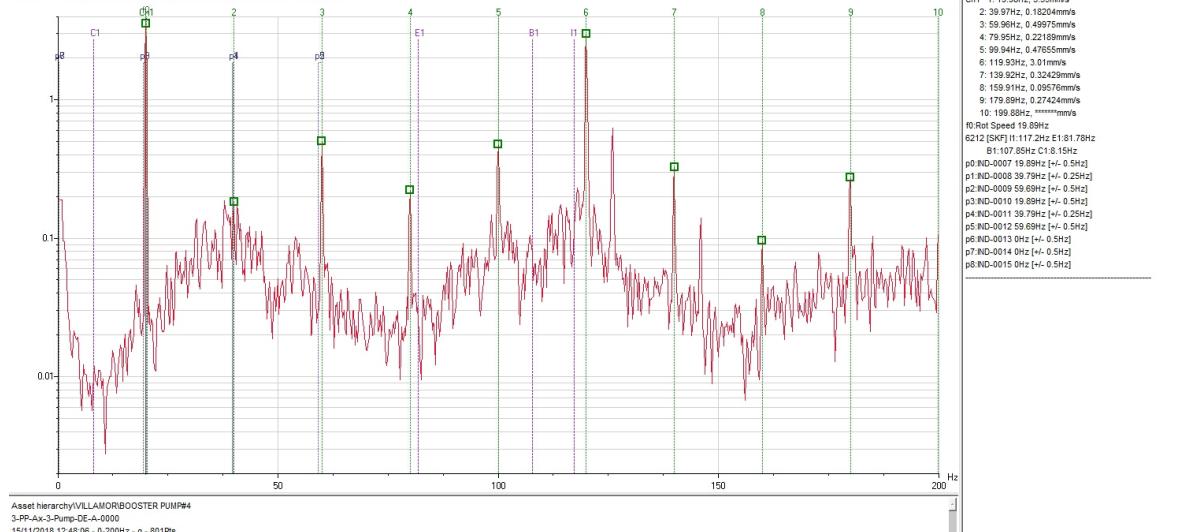
15/11/2018 12:48:01 - 0-63998047s - g - 32768Pts

50bc2.jpg

■ Ch1 [19.98 Hz, 3.95 mm/s] [RMS]: BOOSTER PUMP#4 3-PP-Ax Spectrum LF 15/11/2018 12:50:45

mm/s

15/11/2018 12:48:01 - 0-200Hz - g - 801Pts



BOOSTER PUMP#4 3-PP-Ax Spectrum LF 15/11/2018 12:50:45

Ch1 1.1: 19.98Hz, 3.95mm/s

2: 39.96Hz, 0.18204mm/s

3: 59.96Hz, 0.49975mm/s

4: 79.95Hz, 0.22189mm/s

5: 99.94Hz, 0.47655mm/s

6: 119.93Hz, 3.01mm/s

7: 139.92Hz, 0.32424mm/s

8: 159.91Hz, 0.05674mm/s

9: 179.90Hz, 0.04244mm/s

10: 198.89Hz, ---mm/s

f0 Rot Speed 19.89Hz

6212 SKY (I:117.2K : E:181.78Hz

B1:107.85Hz C1:8.15Hz

p0:IND-0007 19.89Hz [+/- 0.5Hz]

p1:IND-0008 39.79Hz [+/- 0.25Hz]

p2:IND-0009 59.69Hz [+/- 0.5Hz]

p3:IND-0010 79.59Hz [+/- 0.5Hz]

p4:IND-0011 99.59Hz [+/- 0.25Hz]

p5:IND-0012 119.59Hz [+/- 0.5Hz]

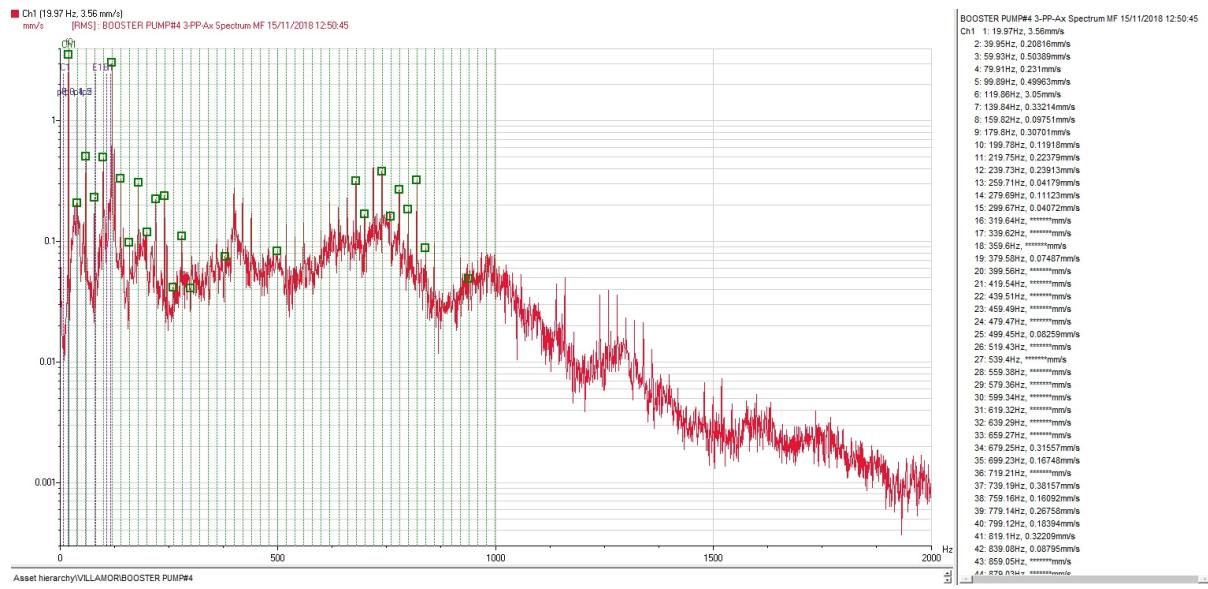
p6:IND-0013 139.59Hz [+/- 0.5Hz]

p7:IND-0014 159.59Hz [+/- 0.5Hz]

p8:IND-0015 179.59Hz [+/- 0.5Hz]

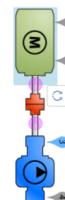
1x RPM peak and 1x Blade Passing - an indications of Misalignment and Cavitations

70648.jpg

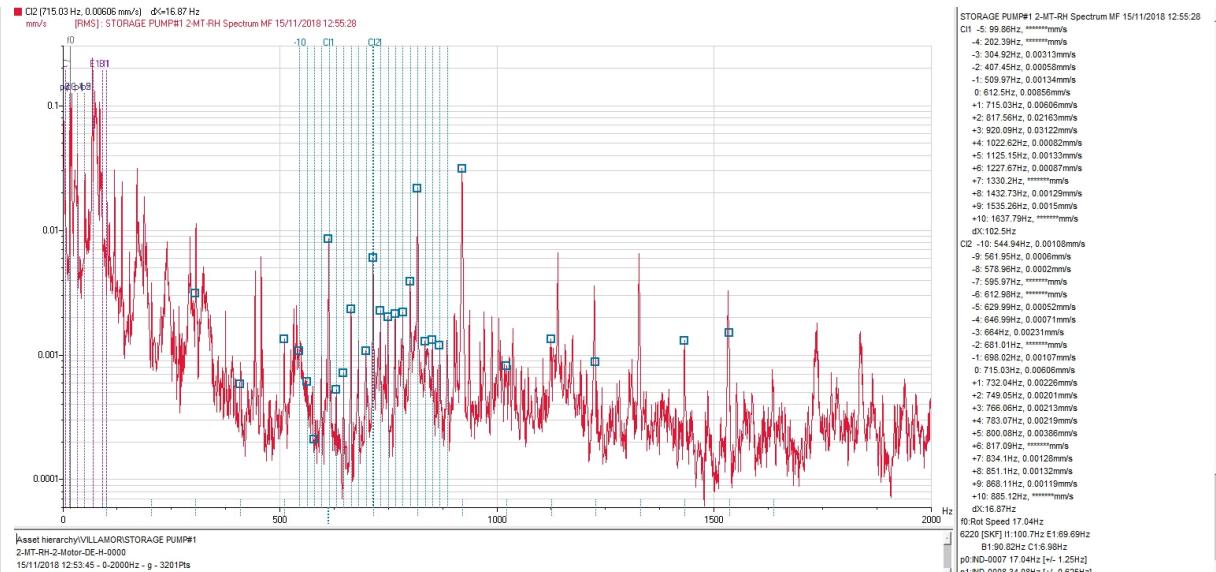


Location	VILLAMOR	
Designation		
Equipment	STORAGE PUMP#1	
Designation		
Abbreviation	SP#1	
Serial No		
Model		
Periodicity (d)	Normal 60	Alarm 15
Previous Advice	Condition	Rotation Speed

Fixed speed

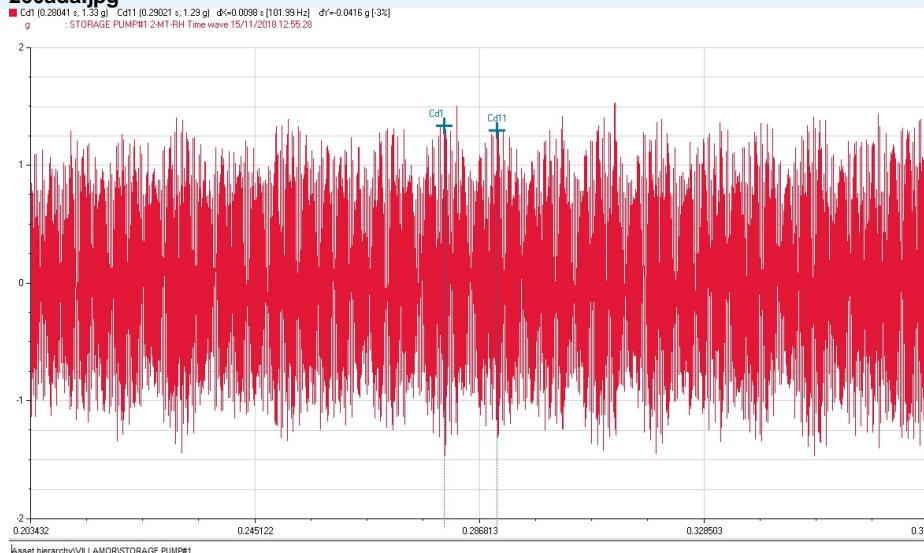


Date 15/11/2018 12:55:28	FAIR <i>Health is not acceptable for a long time service.</i>	Speed 17 Hz / 1022 rpm Author u1 System - Serial FALCON - 11407 Sensor Connector
Condition DfCnd		
Diagnosis & Recommendation		Parameters sheet
Diagnosis		
Early Stage Motor Bearing DE Defect		
Fair state for component 'Electric motor'. Early Stage Motor Bearing DE Defect - Inner Race Good overall state for component 'Pump'.		
Recommendations		
Regrease bearings periodically.		
Regrease bearings periodically. Continue monitor evolution		
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Early Stage Motor DE Bearing Defect

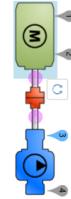
260ada.jpg





Location	VILLAMOR\		
Designation			
Equipment	STORAGE PUMP#2		
Designation			
Abbreviation	SP#2		
Serial No			
Model			
Periodicity (d)	Normal 60	Alarm 15	
Previous Advice	Condition	Rotation Speed	

Fixed speed



Date 15/11/2018 12:44:29	FAIR <i>Health is not acceptable for a long time service.</i>	Speed 17.2 Hz / 1031 rpm
Condition DfCnd		Author u1 System - Serial FALCON - 11407 Sensor Connector

Diagnosis & Recommendation

Diagnosis

Early Stage Motor Bearing DE Defect

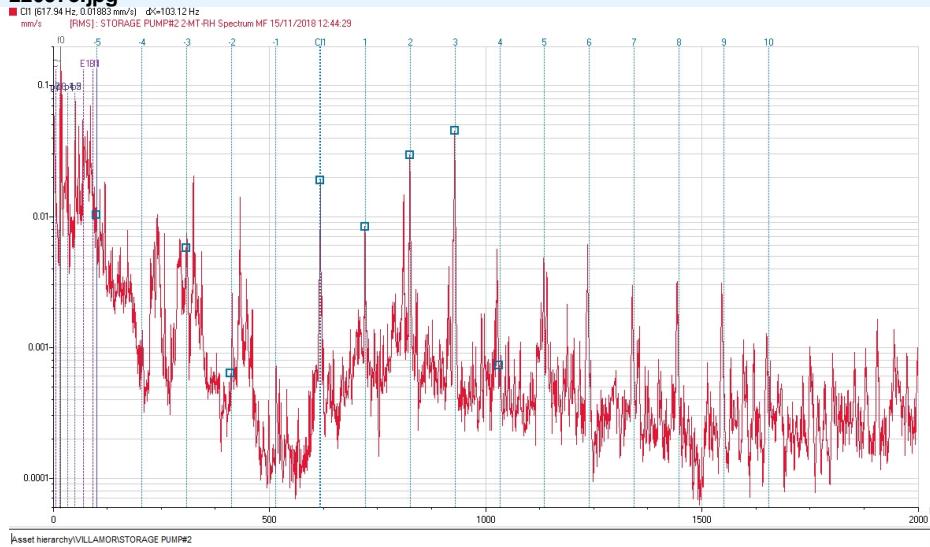
Fair state for component 'Electric motor'.
Early Stage Motor Bearing DE Defect - Inner Race
Good overall state for component 'Pump'.

Recommendations

Regrease bearings periodically

Regrease bearings periodically. Continue monitor evolution

22097e.jpg



STORAGE PUMP#2 2-MT-RH Spectrum MF 15/11/2018 12:44:29

C1 - 5. 100.37Hz, 0.0102mm/s
-4. 203.88Hz, *****mm/s
-3. 307.4Hz, 0.00576mm/s
-2. 410.91Hz, 0.00063mm/s
-1. 514.42Hz, *****mm/s
0. 617.94Hz, 0.01883mm/s
+1. 721.45Hz, 0.0264mm/s
+2. 825.97Hz, 0.0264mm/s
+3. 928.49Hz, 0.0453mm/s
+4. 1031.99Hz, 0.00073mm/s
+5. 1135.51Hz, *****mm/s
+6. 1239.02Hz, *****mm/s
+7. 1342.54Hz, *****mm/s
+8. 1446.05Hz, *****mm/s
+9. 1549.56Hz, *****mm/s
+10. 1653.09Hz, *****mm/s
+11. 1756.62Hz, *****mm/s

10 Rpm Speed 17.10Hz

6220 (SKF) II-101.53Hz ± 1±.70.26Hz
B1.91.56Hz C1.7.04Hz

p0:ND-0007 17.16Hz [-i-.1.25Hz]
p1:ND-0008 34.36Hz [-i-.625Hz]
p2:ND-0009 51.54Hz [-i-.1.25Hz]
p3:ND-0010 17.18Hz [-i-.1.25Hz]
p4:ND-0011 34.36Hz [-i-.625Hz]
p5:ND-0012 51.54Hz [-i-.1.25Hz]
p6:ND-0013 17.18Hz [-i-.1.25Hz]
p7:ND-0014 0Hz [-i-.1.25Hz]
p8:ND-0015 0Hz [-i-.1.25Hz]

Early Stage Motor DE Bearing Defect

c0966.jpg



Cd2 [0.47109 s, 0.9195 g] Cd21 [0.47384 s, 0.9345 g] dx=0.00275 s [63.11 Hz] dy=0.015 g [1%]
g : STORAGE PUMP#2 2-MT-RH Time wave 15/11/2018 12:44:23

STORAGE PUMP#2 2-MT-RH Time wave
Cd1 0.39445s
0.99639g
0.398s
0.9803g
dx[0.00355s, 281.31Hz]
dy:-