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เอกสารผลการตรวจสอบการสิ้นสะท้อน
ของเครื่องจักร



ประจำเดือน มกราคม 2567





Vibration Report

Prepared for

PTT Global Chemical Public Company Limited (GC7 BTF Plant)
Month of Survey and Data Collection: January 2024

Inspected by: PICHET SUKSAI
Reported by: WARUT KAUNBUMRUNG
Approved by: METEE MEERABEAB

Condition Monitoring Service Integrity and Reliability Department



GC Maintenance and Engineering Company Limited

22/2 Pakornsonkhraorat Road, Tambon Maptaphut, Amphoe Muang rayong, Rayong 21150





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Vibration condition monitoring

1. Executive Summary

Measurement Start-Finish: 16 and 23 January 2024

Measurement plan 38 Equipment.

Checked 10 Equipment.

Standby 28 Equipment.

As show in Fig 1 And Table 1

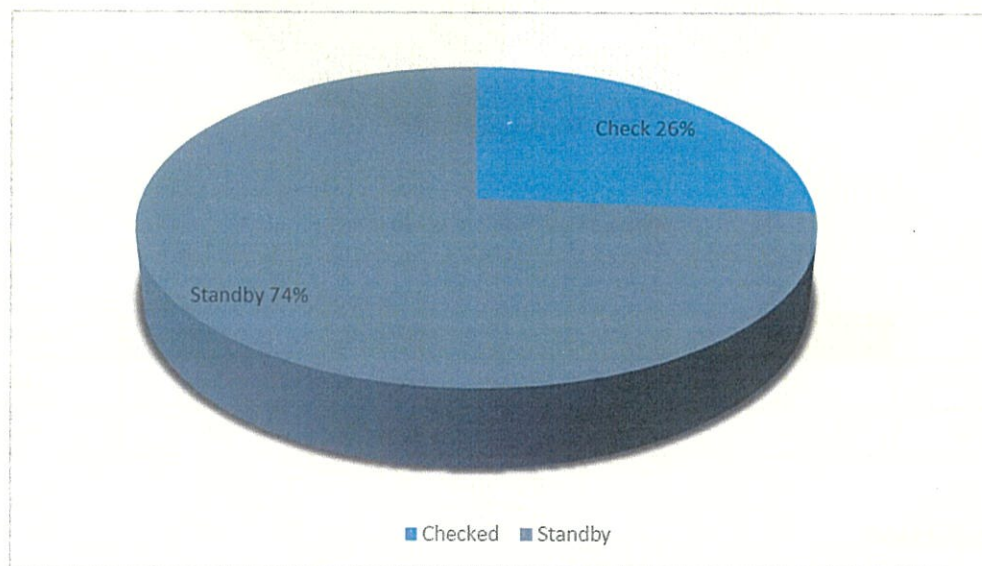
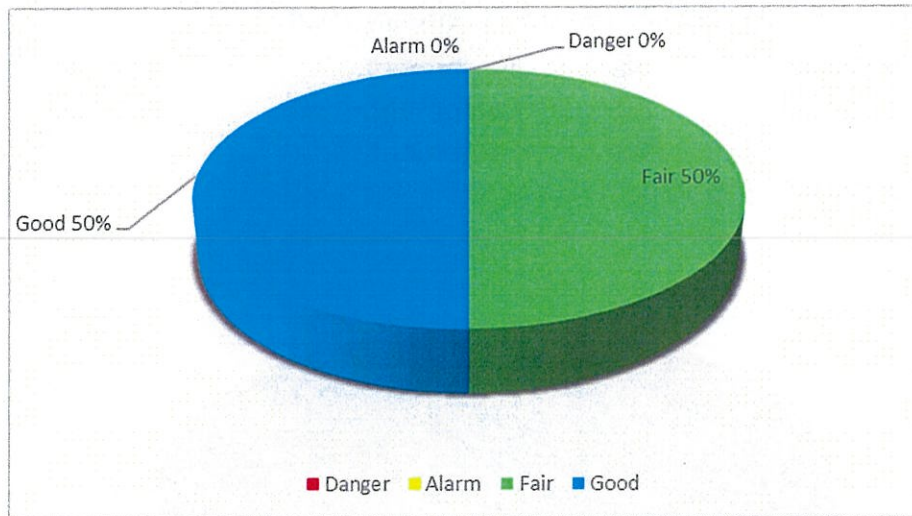


Fig 1

Table 1: Summary of Collected of vibration on PTT GC7 BTF

Item/Status	Measurement plan	Checked	Standby	Grand Total
Unit	38	10	28	38
Percentage	100%	26%	74%	100%

During this period, GCME has collected a vibration data are 10 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Danger	Alarm	Fair	Good	Grand Total
Unit	0	0	5	5	10
Percentage	0%	0%	50%	50%	100%

2. Introduction

PTTGC and GCME has officially signed a yearly contract of "Vibration Monitoring" which a contract's intention is to request GCME to collect a vibration data of specified equipment in accordance with a particular schedule. Vibration data gathered regularly shall be interpreted technically to PTTGC for further action.

Vibration data is carefully collected using portable device branded by EMERSON CSI whose model is "CSI2140; SN: B21402218840 and SN: B21401205571" equipped with an industrial standard accelerometer (CTC SN: 22730 and CTC SN: 323737) Software used for analysis is AMS Machinery Manager.

3. Reference Standard

In order to clearly certify a vibration severity of any equipment, an official international standard which is not only well recognized by worldwide equipment user but also approved by international organization shall be referred to.

PTTGC and GCME agreed to officially apply ISO10816-3 standard for vibration severity assessment for any equipment operated in Refinery plant (PTTGC Branch 6). The vibration severity chart which is an excerpt from ISO10816-3 is shown as the following table herewith.

ISO 10816 Part 3									
Industrial Machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15,000 rpm when measured in situ									
Velocity	Pumps > 15 kW				Medium Size Machines		Large Machines		
10 - 1000 Hz, r > 600 rpm	Radial, Axial, Mixed Flow				15 kW < Power < 300 kW		300 kW < Power < 50 MW		
2 - 1000 Hz, r > 120 rpm	Group 4		Group 3		Group 2		Group 1		
	Integrated Driver		External Driver		160 mm < Motor Height < 315 mm		315 mm < Motor Height		
Limit, mm/s, rms	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 18.0									
11.0 - 18.0									
7.1 - 11.0									
4.5 - 7.1									
3.5 - 4.5									
2.8 - 3.5									
2.3 - 2.8									
1.4 - 2.3									
0.7 - 1.4									
0.0 - 0.7									
	Newly Commissioned								
	Unrestricted long-term operation								
	Restricted long-term operation								
	Vibration causes damage								

Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	Good	Fair	Alarm	Danger
500	≤ 0.2	> 0.2 - 0.5	> 0.5 - 1.8	> 1.8
1000	≤ 0.4	> 0.4 - 1.0	> 1.0 - 3.5	> 3.5
1500	≤ 0.6	> 0.6 - 1.4	> 1.4 - 4.0	> 4.0
3000	≤ 1.4	> 1.4 - 3.0	> 3.0 - 10.0	> 10.0

4. Vibration Severity Listing

Stage of vibration severity and Legend used in a report

The following noteworthy information is a description of each stage of vibration severity.

Stage 4: **Danger** Requires Immediate Attention.

A level of vibration severity at which the probability of a sever fault of machine condition, or other deleterious effects of vibration are considered to be unacceptably high

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 4.5	> 7.1	> 7.1	> 11	> 4.5	> 7.1	> 7.1	> 11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 1.8	> 3.5	> 10	

Stage 3: **Alarm** Requires Attention at Next Opportunity.

A vibration severity level that is greater than normally expected from well designed and constructed machines/equipment, indicating a possible fault in the system. Provided that the vibration is not due to an unacceptable fault that will cause deterioration of the machines, or the vibration does not have other undesirable or unacceptable effects, that such a vibration level may be acceptable.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>2.8-4.5	>4.5-7.1	>4.5-7.1	>7.1-11	>2.8-4.5	>4.5-7.1	>4.5-7.1	>7.1-11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.5	> 1.0	> 3.0	

Stage 2: Fair Keeps Monitoring Failure Trend.

A vibration severity level that is readily achieved by the great majority of machine that is well designed and constructed.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.2	> 0.4	> 1.4	

Stage 1: Good Fault in low level.

The lower limit that could be reasonably expected from the best application of the normal commercial manufacturing practice.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
≤ 0.2	≤ 0.4	≤ 1.4	



5. Vibration Summary Report

Please see the attached table of "Vibration Summary Report"

January 2024				
No.	Tag No.	Severity	Conclusion	Recommended
-	-	-	-	-

6. Vibration Analysis Report

Any equipment whose vibration severity "Alarm" is explained an analysis detail separately.

Please see each of them as attachment.

Appendix A: Severity of machine

GC7_BTf Plant							Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-2024					Jan-24
No.	Eq. Tag	Name Machine	Machine Class	Interval	kW		Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	W01	W02	W03	W04	W05	Summary of Severity
1	B-6921A	Air Compressor	B	1M			Standby	Fair	Fair	Fair	Fair			16-Jan-24			FAIR
7	B-6940-111		A	1M			Standby	Good	Good	Good	Standby			16-Jan-24			Good
15	E-6940-101B		A	1M			Standby	Good	Good	Good	Good			16-Jan-24			Good
26	P-6925-01A	Fire water pump	B	1M			Fair	Fair	Fair	Fair	Fair			16-Jan-24			FAIR
27	P-6925-01B	Fire water pump	B	1M			Fair	Fair	Fair	Fair	Fair			16-Jan-24			FAIR
28	P-6925-01C	Fire water pump	B	1M			Fair	Fair	Fair	Fair	Fair			16-Jan-24			FAIR
37	P-6925-07B	Fire water pump	S	1M			Fair	Standby	Standby	Standby	Fair			16-Jan-24			FAIR
52	N-P-6983-01A		B	1M			Standby	Good	Standby	Standby	Standby				23-Jan-24		Good
53	N-P-6983-01B		B	1M			Good	Standby	Standby	Standby	Standby				23-Jan-24		Good
60	N-P-6983-04A		B	1M			Standby	Standby	Standby	Standby	Standby				23-Jan-24		Good
Number of inspected machine							12	14	20	17	17						10

GOOD	Stage A : (Good) : The vibration of newly commissioned machines would normally fall within this zone.
FAIR	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
ALARM	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the machine may be operated at reduced capacity to avoid damage to themselves.
DAANGER	Stage D: (Not permissible): This zone which falls into zone are normally considered to be a sufficient warning to cause damage to themselves.
Not operate as running program	Not operate as running program ; Machine do not run as running program.
Out of service	Out of service : Cannot measure due to machine do not run as a result of machine overhaul to repair inaccessible, shut down, turn around.
Cannot check	Cannot check : Cannot measure even though machine is running caused by prohibited area, gas leaks, no platform or other problems from the factory.
Out of plan	Out of plan: Machine do not have plan to measure vibration based on running program.

ประจำเดือน กุมภาพันธ์ 2567





Vibration Report

Prepared for

PTT Global Chemical Public Company Limited (GC7 BTF Plant)

Month of Survey and Data Collection: February 2024

Inspected by: PICHET SUKSAI

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

Condition Monitoring Service Integrity and Reliability Department



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Vibration condition monitoring

1. Executive Summary

Measurement Start-Finish: 13 and 20 February 2024

Measurement plan 38 Equipment.

Checked 13 Equipment.

Standby 25 Equipment.

As show in Fig 1 And Table 1

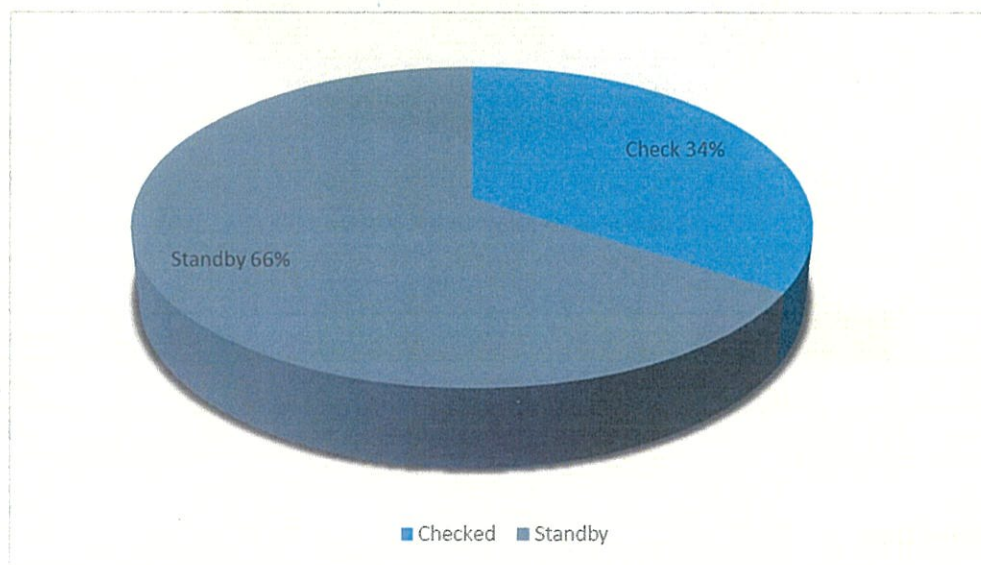
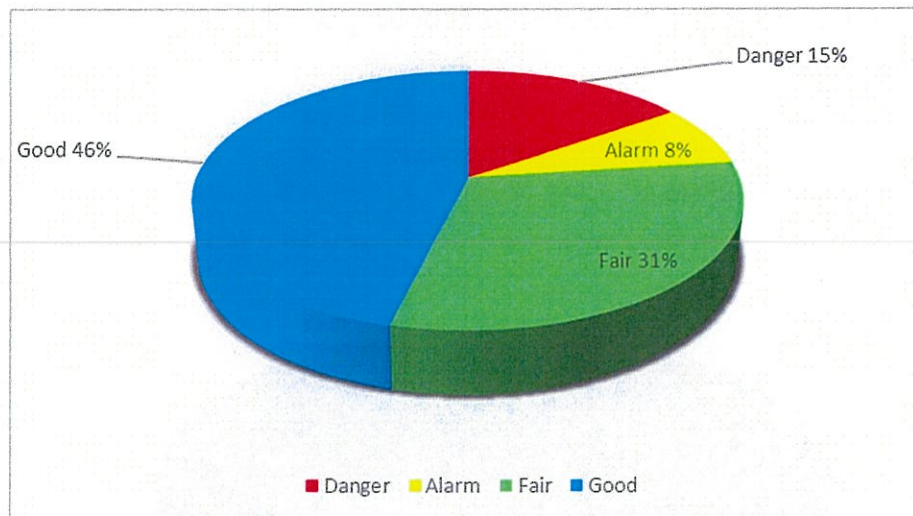


Fig 1

Table 1: Summary of Collected of vibration on PTT GC7 BTF

Item/Status	Measurement plan	Checked	Standby	Grand Total
Unit	38	13	25	38
Percentage	100%	34%	66%	100%

During this period, GCME has collected a vibration data are 13 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Danger	Alarm	Fair	Good	Grand Total
Unit	2	1	4	6	13
Percentage	15%	8%	31%	46%	100%

2. Introduction

PTTGC and GCME has officially signed a yearly contract of "Vibration Monitoring" which a contract's intention is to request GCME to collect a vibration data of specified equipment in accordance with a particular schedule. Vibration data gathered regularly shall be interpreted technically to PTTGC for further action.

Vibration data is carefully collected using portable device branded by EMERSON CSI whose model is "CSI2140; SN: B21402218840 and SN: B21401205571" equipped with an industrial standard accelerometer (CTC SN: 22730 and CTC SN: 323737) Software used for analysis is AMS Machinery Manager.

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Industrial Machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15,000 rpm when measured inside									
Velocity	Pumps > 15 kW				Medium Size Machines		Large Machines		
10 - 1000 Hz, r > 600 rpm	Radial, Axial, Mixed Flow				15 kW < Power < 300 kW		300 kW < Power < 50 MW		
2 - 1000 Hz, r > 120 rpm	Group 4		Group 3		Group 2		Group 1		
	Integrated Driver		External Driver		160 mm < Motor Height < 315 mm		315 mm < Motor Height		
Limit, mm/s, rms	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 18.0									
11.0 - 18.0									
7.1 - 11.0									
4.5 - 7.1									
3.5 - 4.5									
2.8 - 3.5									
2.3 - 2.8									
1.4 - 2.3									
0.7 - 1.4									
0.0 - 0.7									
	Newly Commissioned								
	Unrestricted long-term operation								
	Restricted long-term operation								
	Vibration causes damage								

Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	Good	Fair	Alarm	Danger
500	≤ 0.2	$> 0.2 - 0.5$	$> 0.5 - 1.8$	> 1.8
1000	≤ 0.4	$> 0.4 - 1.0$	$> 1.0 - 3.5$	> 3.5
1500	≤ 0.6	$> 0.6 - 1.4$	$> 1.4 - 4.0$	> 4.0
3000	≤ 1.4	$> 1.4 - 3.0$	$> 3.0 - 10.0$	> 10.0

4. Vibration Severity Listing

Stage of vibration severity and Legend used in a report

The following noteworthy information is a description of each stage of vibration severity.

Stage 4: **Danger** Requires Immediate Attention.

A level of vibration severity at which the probability of a sever fault of machine condition, or other deleterious effects of vibration are considered to be unacceptably high

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 4.5	> 7.1	> 7.1	> 11	> 4.5	> 7.1	> 7.1	> 11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 1.8	> 3.5	> 10	

Stage 3: **Alarm** Requires Attention at Next Opportunity.

A vibration severity level that is greater than normally expected from well designed and constructed machines/equipment, indicating a possible fault in the system. Provided that the vibration is not due to an unacceptable fault that will cause deterioration of the machines, or the vibration does not have other undesirable or unacceptable effects, that such a vibration level may be acceptable.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.5	> 1.0	> 3.0	

Stage 2: Fair Keeps Monitoring Failure Trend.

A vibration severity level that is readily achieved by the great majority of machine that is well designed and constructed.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.2	> 0.4	> 1.4	

Stage 1: Good Fault in low level.

The lower limit that could be reasonably expected from the best application of the normal commercial manufacturing practice.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
≤ 0.2	≤ 0.4	≤ 1.4	

5. Vibration Summary Report

Please see the attached table of "Vibration Summary Report"

February 2024				
No.	Tag No.	Severity	Conclusion	Recommended
1	BM-112	DANGER	DANGER on since Nov-23. Motor: Motor is in normal condition. Blower: Suspect looseness of rotating part problem due to clearance of bearing and/or gear assembly had change.	Motor: Should be keep monitor trend of vibration and peakvue mode in monthly interval. Blower: 1. 1st activity should be plan for dilute lube oil as soon as possible. 2. Short-term , should keep monitor trend of vibration and peakvue mode in monthly interval. 3. Long-term , if vibration continues increase and/or peakvue mode continues increase more than 10% from latest measurement, should be plan action as below step. 3.1 Should plan inspection tolerance fitting of bearing housing, also gear assembly and condition of lobe blower if necessary. If the overall value of tolerance fitting not accepted by refer operation manual, should overhaul blower. 3.2 Should be plan for replace all new blower bearing.
2	BM-113	ALARM	ALARM on since Oct-23. Motor: Motor is in normal condition. Blower: Suspect looseness of rotating part problem due to clearance of bearing and/or gear assembly had change.	Motor: Should be keep monitor trend of vibration and peakvue mode in monthly interval. Blower: 1. 1st activity should be plan for dilute lube oil as soon as possible. 2. Short-term , should keep monitor trend of vibration and peakvue mode in monthly interval. 3. Long-term , if vibration continues increase and/or peakvue mode continues increase more than 10% from latest measurement, should be plan action as below step. 3.1 Should plan inspection tolerance fitting of bearing housing, also gear assembly and condition of lobe blower if necessary. If the overall value of tolerance fitting not accepted by refer operation manual, should overhaul blower. 3.2 Should be plan for replace all new blower bearing.

February 2024				
No.	Tag No.	Severity	Conclusion	Recommended
3	BM-114	DANGER	<p><u>DANGER on since Nov-23.</u></p> <p>Motor: Motor is in normal condition.</p> <p>Blower: Suspect looseness of rotating part problem due to clearance of bearing and/or gear assembly had change.</p>	<p>Motor: Should be keep monitor trend of vibration and peakvue mode in monthly interval.</p> <p>Blower:</p> <ol style="list-style-type: none"> 1. 1st activity should be plan for dilute lube oil as soon as possible. 2. Short-term, should keep monitor trend of vibration and peakvue mode in monthly interval. 3. Long-term, if vibration continues increase and/or peakvue mode continues increase more than 10% from latest measurement, should be plan action as below step. <ol style="list-style-type: none"> 3.1 Should plan inspection tolerance fitting of bearing housing, also gear assembly and condition of lobe blower if necessary. If the overall value of tolerance fitting not accepted by refer operation manual, should overhaul blower. 3.2 Should be plan for replace all new blower bearing.

6. Vibration Analysis Report

Any equipment whose vibration severity "Alarm" is explained an analysis detail separately.
Please see each of them as attachment.

Appendix A: Severity of machine

GC7_BTTF Plant

No.	Eq. Tag	Name Machine	Machine Class	Interval	kW	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-2024				Feb-24
						Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	W06	W07	W08	W09	Summary of Severity
2	B-6921B	Air Compressor	B	1M		Standby	Standby	Standby	Standby	Not operate as running program			20-Feb-24		Good
6	B-6940-11		A	1M		Good	Good	Good	Standby	Not operate as running program			20-Feb-24		Good
7	B-6940-111		A	1M		Good	Good	Good	Standby	Good			20-Feb-24		Fair
13	E-6940-01B		A	1M		Good	Standby	Standby	Fair	Not operate as running program			20-Feb-24		Good
15	E-6940-101B		A	1M		Good	Good	Good	Good	Good			20-Feb-24		Good
26	P-6925-01A	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair		13-Feb-24			FAIR
27	P-6925-01B	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair		13-Feb-24			FAIR
28	P-6925-01C	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair		13-Feb-24			FAIR
46	BM-111		B	1M		Standby	Good	Fair	Good	Not operate as running program		13-Feb-24			GOOD
47	BM-112		B	1M		Standby	Alarm	Danger	Danger	Not operate as running program		13-Feb-24			DANGER
48	BM-113		B	1M		Standby	Alarm	Alarm	Alarm	Not operate as running program		13-Feb-24			ALARM
49	BM-114		B	1M		Standby	Alarm	Danger	Danger	Not operate as running program		13-Feb-24			DANGER
60	N-P-6983-04A		B	1M		Standby	Standby	Standby	Standby	Good		13-Feb-24			GOOD
Number of inspected machine						14	20	17	17	10					13

GOOD	Stage A : (Good) The vibration of newly commissioned machines would normally fall within this zone.
FAIR	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
ALARM	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the machine may be operated Stage D : (Not permissible). Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.
DANGER	Not operate as running program : Machine do not run as running program.
Not operate as running program	Out of service : Cannot measure due to machine do not run as a result of machine overhaul to repair inaccessible, shut down, turn around.
Out of service	Cannot check : Cannot measure even though machine is running caused by prohibited area, gas leaks, no platform or other problems from the factory.
Cannot check	Out of plan : Machines do not have plan to measure vibration based on running program.

ประจำเดือน มีนาคม 2567





Vibration Report

Prepared for

PTT Global Chemical Public Company Limited (GC7 BTF Plant)

Month of Survey and Data Collection: March 2024

Inspected by: PICHET SUKSAI

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

Condition Monitoring Service Integrity and Reliability Department

 GC Maintenance and Engineering Company Limited

22/2 Pakornsonkhraorat Road, Tambon Maptaphut, Amphoe Muang rayong, Rayong 21150





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Vibration condition monitoring

1. Executive Summary

Measurement Start-Finish: 5 and 19 March 2024

Measurement plan 38 Equipment.

Checked 15 Equipment.

Standby 23 Equipment.

As show in Fig 1 And Table 1

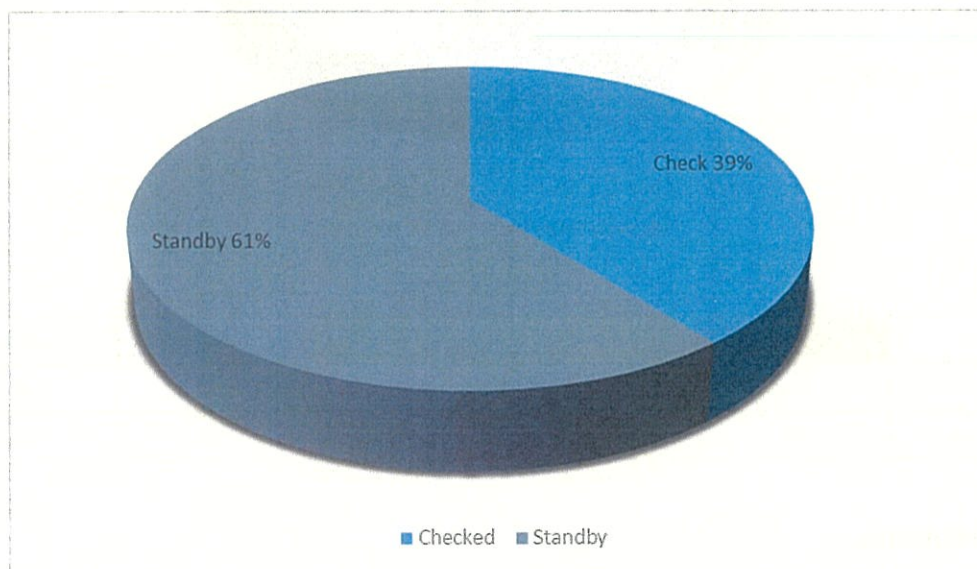
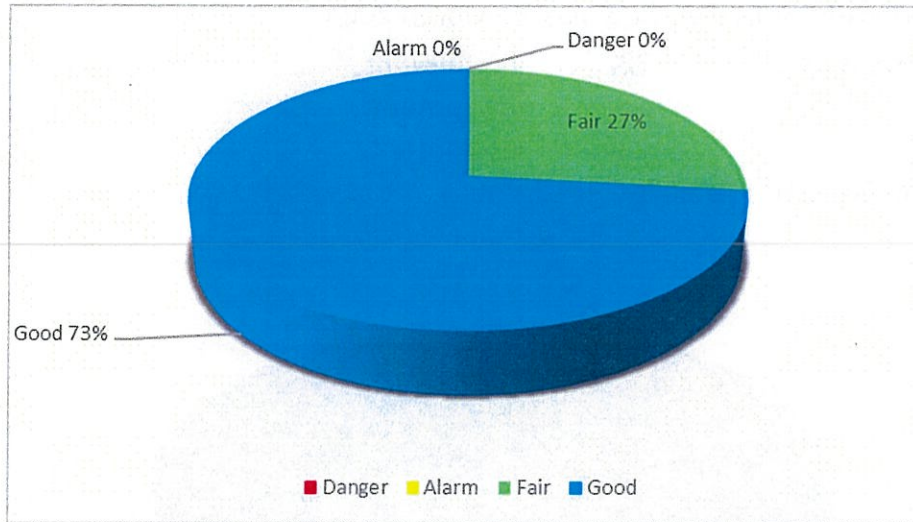


Fig 1

Table 1: Summary of Collected of vibration on PTT GC7 BTF

Item/Status	Measurement plan	Checked	Standby	Grand Total
Unit	38	15	23	38
Percentage	100%	39%	61%	100%

During this period, GCME has collected a vibration data are 15 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Danger	Alarm	Fair	Good	Grand Total
Unit	0	0	4	11	15
Percentage	0%	0%	27%	73%	100%

2. Introduction

PTTGC and GCME has officially signed a yearly contract of "Vibration Monitoring" which a contract's intention is to request GCME to collect a vibration data of specified equipment in accordance with a particular schedule. Vibration data gathered regularly shall be interpreted technically to PTTGC for further action.

Vibration data is carefully collected using portable device branded by EMERSON CSI whose model is "CSI2140; SN: B21402218840 and SN: B21401205571" equipped with an industrial standard accelerometer (CTC SN: 22730 and CTC SN: 323737) Software used for analysis is AMS Machinery Manager.

3. Reference Standard

In order to clearly certify a vibration severity of any equipment, an official international standard which is not only well recognized by worldwide equipment user but also approved by international organization shall be referred to.

PTTGC and GCME agreed to officially apply ISO10816-3 standard for vibration severity assessment for any equipment operated in Refinery plant (PTTGC Branch 6). The vibration severity chart which is an excerpt from ISO10816-3 is shown as the following table herewith.

ISO 10816 Part 3									
Industrial Machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15,000 rpm when measured inside									
Velocity	Pumps > 15 kW				Medium Size Machines		Large Machines		
10 - 1000 Hz, r > 600 rpm	Radial, Axial, Mixed Flow				15 kW < Power < 300 kW		300 kW < Power < 50 MW		
2 - 1000 Hz, r > 120 rpm	Group 4		Group 3		Group 2		Group 1		
	Integrated Driver		External Driver		160 mm < Motor Height < 315 mm		315 mm < Motor Height		
Limit, mm/s, rms	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 18.0									
11.0 - 18.0									
7.1 - 11.0									
4.5 - 7.1									
3.5 - 4.5									
2.8 - 3.5									
2.3 - 2.8									
1.4 - 2.3									
0.7 - 1.4									
0.0 - 0.7									
	Newly Commissioned								
	Unrestricted long-term operation								
	Restricted long-term operation								
	Vibration causes damage								

Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	Good	Fair	Alarm	Danger
500	≤ 0.2	> 0.2 - 0.5	> 0.5 - 1.8	> 1.8
1000	≤ 0.4	> 0.4 - 1.0	> 1.0 - 3.5	> 3.5
1500	≤ 0.6	> 0.6 - 1.4	> 1.4 - 4.0	> 4.0
3000	≤ 1.4	> 1.4 - 3.0	> 3.0 - 10.0	> 10.0

4. Vibration Severity Listing

Stage of vibration severity and Legend used in a report

The following noteworthy information is a description of each stage of vibration severity.

Stage 4: **Danger** Requires Immediate Attention.

A level of vibration severity at which the probability of a sever fault of machine condition, or other deleterious effects of vibration are considered to be unacceptably high

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 4.5	> 7.1	> 7.1	> 11	> 4.5	> 7.1	> 7.1	> 11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 1.8	> 3.5	> 10	

Stage 3: **Alarm** Requires Attention at Next Opportunity.

A vibration severity level that is greater than normally expected from well designed and constructed machines/equipment, indicating a possible fault in the system. Provided that the vibration is not due to an unacceptable fault that will cause deterioration of the machines, or the vibration does not have other undesirable or unacceptable effects, that such a vibration level may be acceptable.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.5	> 1.0	> 3.0	

Stage 2: Fair Keeps Monitoring Failure Trend.

A vibration severity level that is readily achieved by the great majority of machine that is well designed and constructed.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 0.2	> 0.4	> 1.4	

Stage 1: Good Fault in low level.

The lower limit that could be reasonably expected from the best application of the normal commercial manufacturing practice.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
≤ 0.2	≤ 0.4	≤ 1.4	



5. Vibration Summary Report

Please see the attached table of "Vibration Summary Report"

March 2024				
No.	Tag No.	Severity	Conclusion	Recommended
-	-	-	-	-

6. Vibration Analysis Report

Any equipment whose vibration severity "Alarm" is explained an analysis detail separately.

Please see each of them as attachment.

Appendix A: Severity of machine

GC7_BTF Plant

GC7_BTF Plant															
No.	Eq. Tag	Name Machine	Machine Class	Interval	kW	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-2024				Mar-24
						Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	W10	W11	W12	W13	Summary of Severity
3	B-6921C	Air Compressor	B	1M		Standby	Standby	Standby	Not operate as running program	Not operate as running program			19-Mar-24		FAIR
7	B-6940-111		A	1M		Good	Good	Standby	Good	Fair			19-Mar-24		GOOD
12	E-6940-01A		A	1M		Good	Good	Fair	Not operate as running program	Not operate as running program			19-Mar-24		GOOD
14	E-6940-101A		A	1M		Standby	Good	Good	Not operate as running program	Not operate as running program			19-Mar-24		GOOD
16	G-6871		A	1M		Fair	Standby	Standby	Not operate as running program	Not operate as running program	5-Mar-24				GOOD
23	P-6872		B	1M		Good	Standby	Standby	Not operate as running program	Not operate as running program	5-Mar-24				GOOD
24	P-6873A		B	1M		Standby	Standby	Standby	Not operate as running program	Not operate as running program	5-Mar-24				GOOD
26	P-6925-01A	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair	5-Mar-24				FAIR
27	P-6925-01B	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair	5-Mar-24				FAIR
28	P-6925-01C	Fire water pump	B	1M		Fair	Fair	Fair	Fair	Fair	5-Mar-24				FAIR
38	G-6904		A	1M		Standby	Standby	Standby	Not operate as running program	Not operate as running program	5-Mar-24				GOOD
53	N-P-6983-01B			1M		Standby	Standby	Standby	Good	Not operate as running program			19-Mar-24		GOOD
60	N-P-6983-04A			1M		Standby	Standby	Standby	Good	GOOD			19-Mar-24		GOOD
65	N-P-6981A			1M		Good	Standby	Standby	Not operate as running program	Not operate as running program			19-Mar-24		GOOD
67	P-6930-01			1M		Standby	Standby	Standby	Not operate as running program	Not operate as running program			19-Mar-24		GOOD
Number of inspected machine						20	17	17	10	13					15

ประจำเดือนเมษายน 2567





Vibration Report

Prepared for

PTT Global Chemical Public Company Limited (GC7 BTF Plant)

Month of Survey and Data Collection: April 2024

Request for Measurement

Inspected by: PICHET SUKSAI

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

Condition Monitoring Service Integrity and Reliability Department



GC Maintenance and Engineering Company Limited

22/2 Pakornsonkhraorat Road, Tambon Maptaphut, Amphoe Muang rayong, Rayong 21150





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3. Reference Standard	Error! Bookmark not defined.
4. Vibration Severity Listing	Error! Bookmark not defined.
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Vibration condition monitoring

1. Executive Summary

Request for measurement 1 Equipment.

Including as below

- In planned 0 Equipment.
- Out of planned 1 Equipment.

List of machines for request to measure vibration as table below.

LIST OF REQUEST MACHINERY VIBRATION IN PLANNED			
No.	Tag	Date of request	Remark
N/A	N/A	N/A	N/A

LIST OF REQUEST MACHINERY VIBRATION OUT OF PLANNED			
No.	Tag	Date of request	Remark
1	P-6981R	29-Apr-24	Test pump while low level transfer.



2. Introduction

PTTGC and GCME has officially signed a yearly contract of "Vibration Monitoring" which a contract's intention is to request GCME to collect a vibration data of specified equipment in accordance with a particular schedule. Vibration data gathered regularly shall be interpreted technically to PTTGC for further action.

Vibration data is carefully collected using portable device branded by EMERSON CSI whose model is "CSI2140; SN: B21402218840 and SN: B21401205571" equipped with an industrial standard accelerometer (CTC SN: 22730 and CTC SN: 323737) Software used for analysis is AMS Machinery Manager.

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Industrial Machines with nominal power above 15 kW and nominal speeds between 120 rpm and 15,000 rpm when measured in situ									
Velocity 10 - 1000 Hz, r > 600 rpm 2 - 1000 Hz, r > 120 rpm	Pumps > 15 kW				Medium Size Machines		Large Machines		
	Radial, Axial, Mixed Flow				15 kW < Power < 300 kW		300 kW < Power < 50 MW		
	Group 4		Group 3		Group 2		Group 1		
	Integrated Driver		External Driver		160 mm < Motor Height < 315 mm		315 mm < Motor Height		
Limit, mm/s, rms	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 18.0									
11.0 - 18.0									
7.1 - 11.0									
4.5 - 7.1									
3.5 - 4.5									
2.8 - 3.5									
2.3 - 2.8									
1.4 - 2.3									
0.7 - 1.4									
0.0 - 0.7									
	Newly Commissioned								
	Unrestricted long-term operation								
	Restricted long-term operation								
	Vibration causes damage								

Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	Good	Fair	Alarm	Danger
500	≤ 0.2	$> 0.2 - 0.5$	$> 0.5 - 1.8$	> 1.8
1000	≤ 0.4	$> 0.4 - 1.0$	$> 1.0 - 3.5$	> 3.5
1500	≤ 0.6	$> 0.6 - 1.4$	$> 1.4 - 4.0$	> 4.0
3000	≤ 1.4	$> 1.4 - 3.0$	$> 3.0 - 10.0$	> 10.0

4. Vibration Severity Listing

Stage of vibration severity and Legend used in a report

The following noteworthy information is a description of each stage of vibration severity.

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Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
> 4.5	> 7.1	> 7.1	> 11	> 4.5	> 7.1	> 7.1	> 11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
> 1.8	> 3.5	> 10	

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A vibration severity level that is greater than normally expected from well designed and constructed machines/equipment, indicating a possible fault in the system. Provided that the vibration is not due to an unacceptable fault that will cause deterioration of the machines, or the vibration does not have other undesirable or unacceptable effects, that such a vibration level may be acceptable.

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>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	>2.8 -4.5	>4.5 -7.1	>4.5 -7.1	>7.1 -11	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
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> 0.5	> 1.0	> 3.0	

Stage 2: Fair Keeps Monitoring Failure Trend.

A vibration severity level that is readily achieved by the great majority of machine that is well designed and constructed.

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Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	>1.4 - 2.8	>2.3 - 4.5	>2.3 - 4.5	>3.5 - 7.1	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
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> 0.2	> 0.4	> 1.4	

Stage 1: Good Fault in low level.

The lower limit that could be reasonably expected from the best application of the normal commercial manufacturing practice.

Group 4		Group 3		Group 2		Group 1		Limit, mm/s, RMS
Pumps > 15 kW radial, axial, mixed flow				Medium sized machines 15 kW<P<300 kW		Large sized machines 300 kW<P<50 kW		
Integrated driver		External driver		Motor 160mm ≤ H <315mm		Motor 315mm ≤ H		
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	
≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	≤ 1.4	≤ 2.3	≤ 2.3	≤ 3.5	

Vibration Peakvue Acceleration Severity (Shaft Diameter Speed)			Limit, g-s, RMS
Dia between 200 & 500 mm Speed < 500 RPM	Dia between 50 & 300 mm Speed Between 500 & 1000 RPM	Dia between 20 & 150 mm Speed is either 1800 or 3600 RPM	
≤ 0.2	≤ 0.4	≤ 1.4	

5. Vibration Summary Report

Please see the attached table of "Requested Machine Vibration Summary Report" In Planned

Request machinery vibration (In planned) April 2024				
No.	Tag No.	Severity	Conclusion	Recommended
N/A	N/A	N/A	N/A	N/A

Please see the attached table of "Requested Machine Vibration Summary Report" Out of Planned

Request machinery vibration (Out of planned) April 2024				
No.	Tag No.	Severity	Conclusion	Recommended
1	P-6981R	GOOD	Test pump while low level transfer. Motor: Motor is in normal condition. Pump: Pump is in normal condition.	Motor: Should be keep monitor trend of vibration and Peakvue mode in <u>routine interval</u> . Pump: Should be keep monitor trend of vibration and Peakvue mode in <u>routine interval</u> .

6. Vibration Analysis Report

Any equipment whose vibration severity ""Good, Fair, Alarm and Danger"" for in planned and out of planned are explained an analysis detail separately. Please see each of them as attachment.

Tag: P-6981R

Severity: **GOOD**

Area: GC7_BTF

Machine name: BUTENE-1/LPG TRANSFER PUMP

Date of data measurement: 29 April 2024

Main problem: [Test low level transfer](#). Normal condition.

Inspected by: Supol K.

Analyst by: Pichet S.

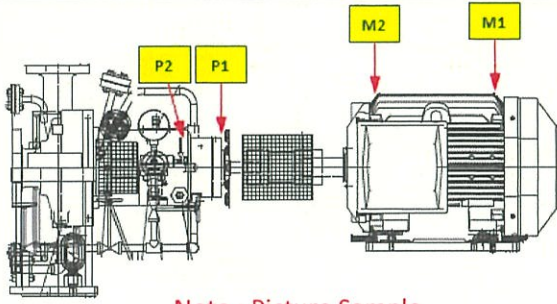
Review by: Warut K.

Reference criteria

Standard	Good	Fair	Alarm	Danger	Unit
ISO-10816 part 3 (Group 3, Flexible)	≤ 2.3	$> 2.3 - 4.5$	$> 4.5 - 7.1$	> 7.1	mm/s RMS
CSI Vibration Peakvue Acceleration	≤ 3.95	$> 3.95 - 8.46$	$> 8.46 - 28.2$	> 28.2	G-s, PK-PK

Remark: ISO-10816 provides specific guidance for assessing the severity of vibration measured on machine in steady state, thus GCME will considers the magnitude of vibration, the changes in the magnitude and frequency for judging the severity of vibration.

Machine description and vibration measurement point

 <p>Note : Picture Sample</p>	<p>Motor Manufacturer: Reliance Power: 60 kw. Speed: 2950 rpm DE Bearing: 6312 NDE Bearing: 6310</p> <p>Pump Speed = 2950 rpm Transmission: Coupling DE Bearing = N/A NDE Bearing = N/A Blades: N/A</p>
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Vibration analysis

Motor

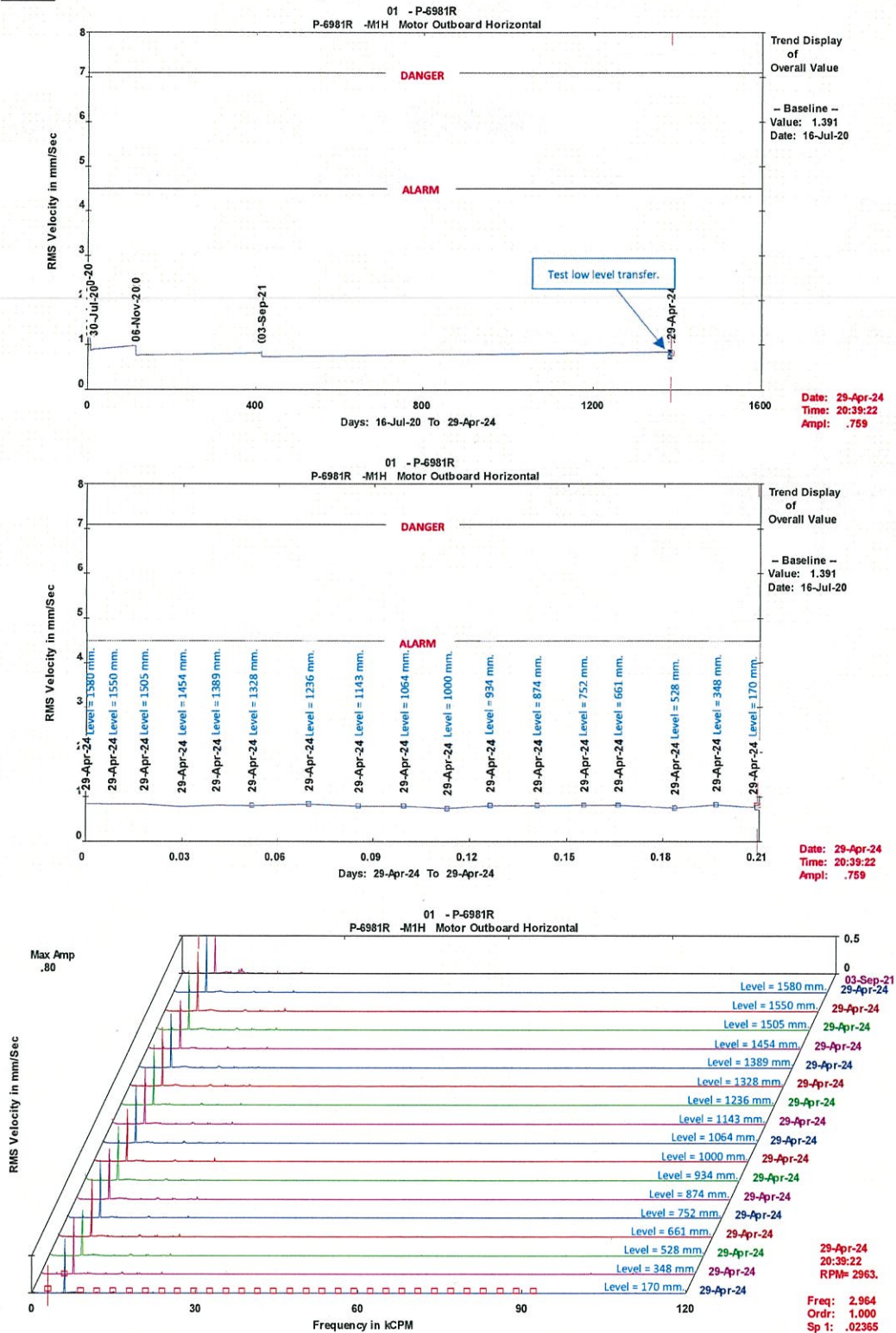


Fig1: Trend/Waterfall/Spectrum Plot Point 1: Motor – NDE – Horizontal– Velocity.

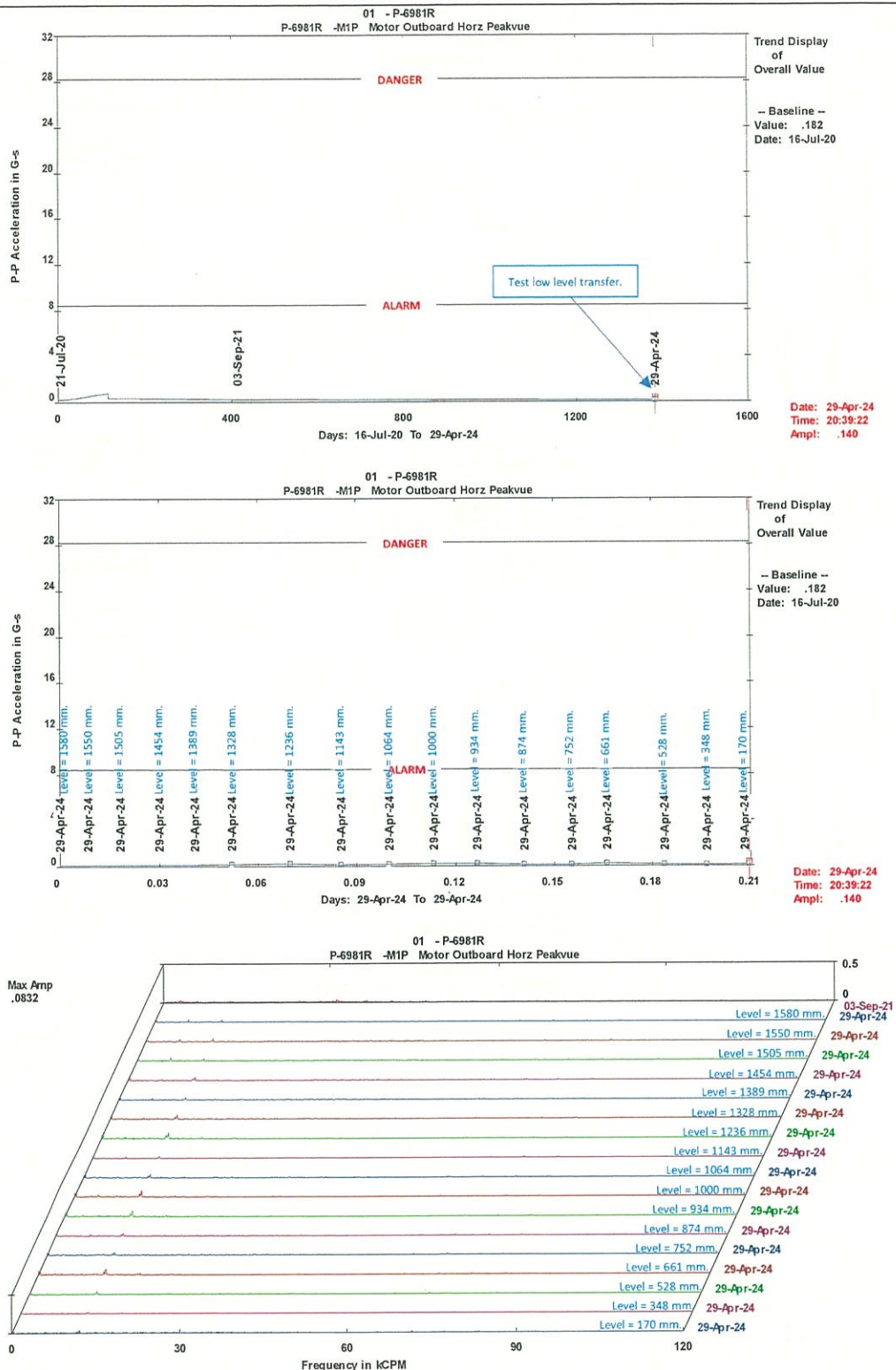
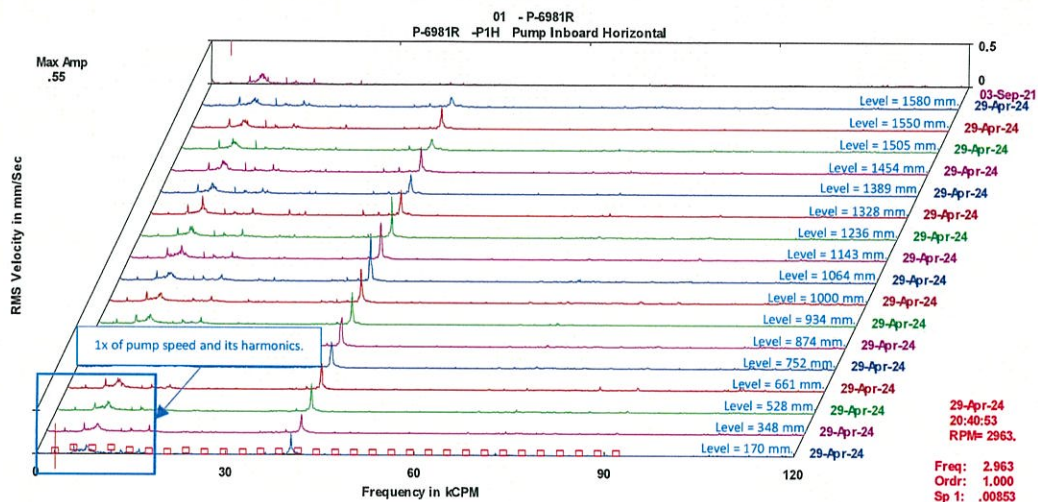
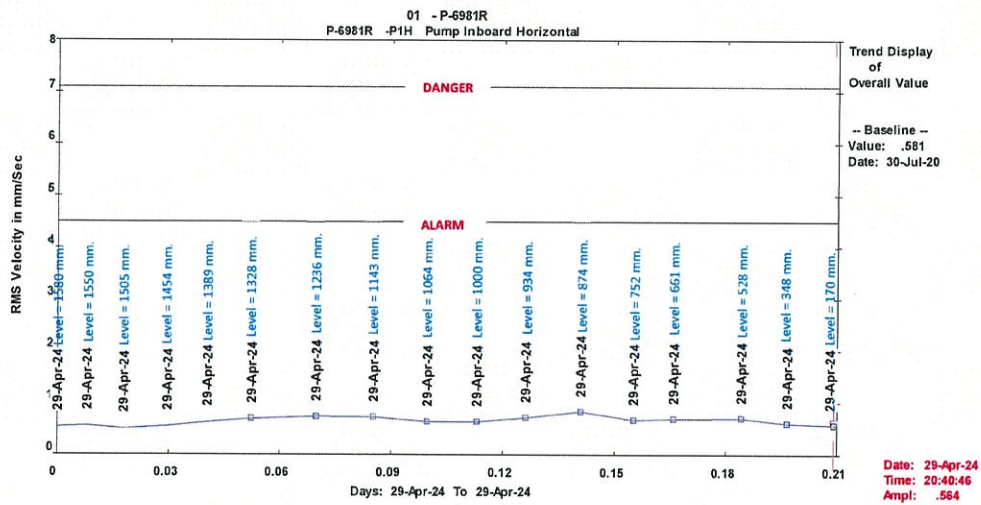
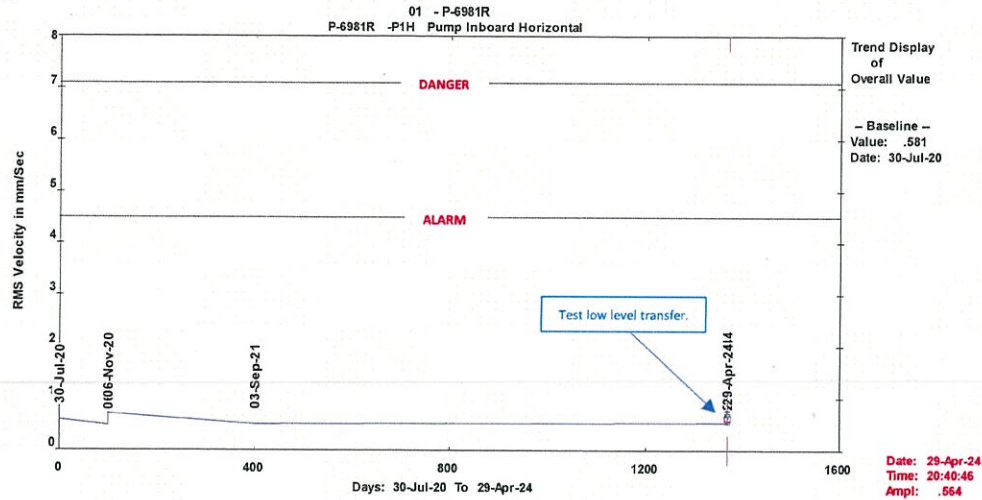


Fig2: Trend/Waterfall/Spectrum Plot Point 1: Motor – NDE – Horizontal – Acceleration of Peakvue mode.

■ Pump



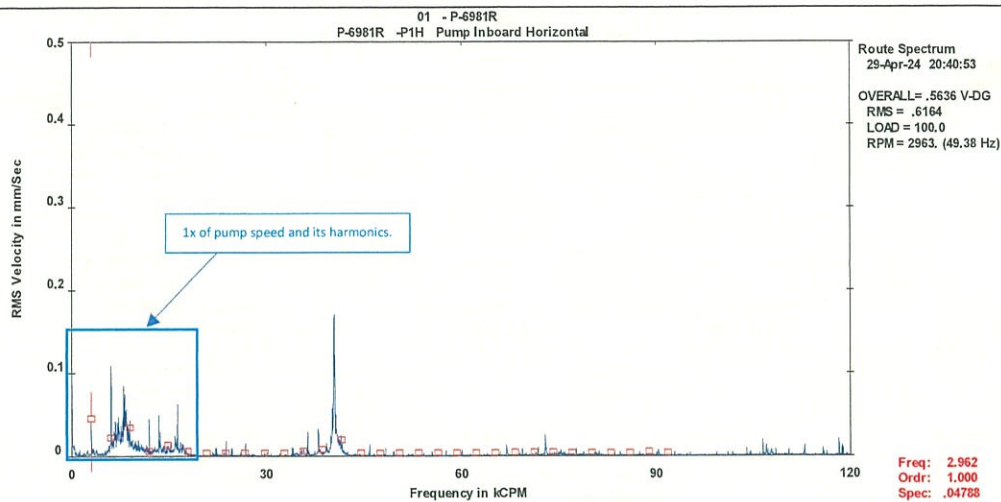
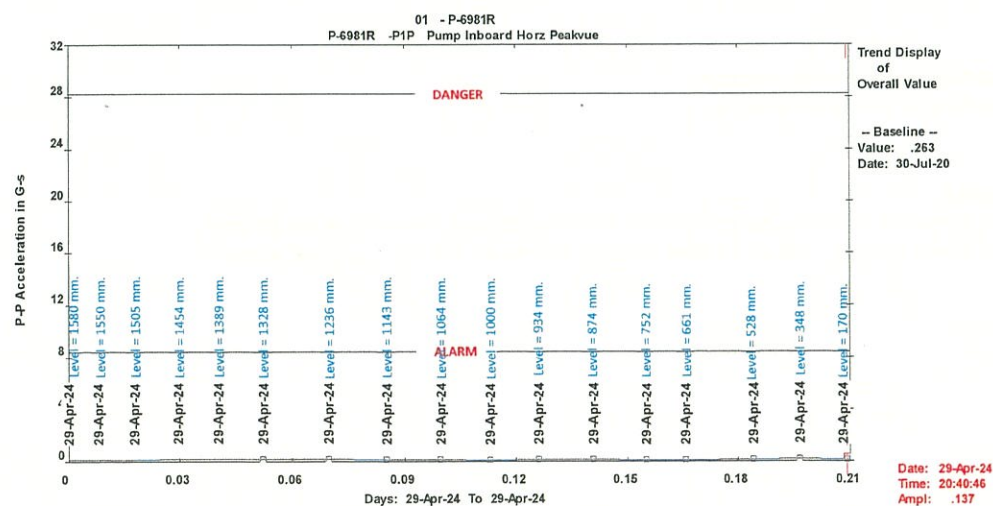
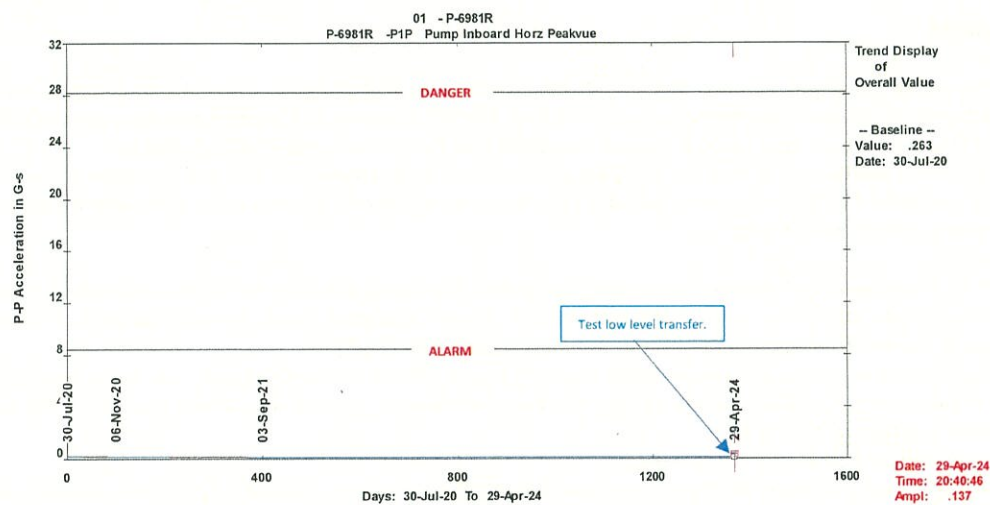


Fig3: Trend/Waterfall/Spectrum Plot Point P1: Pump – DE – Horizontal – Velocity.



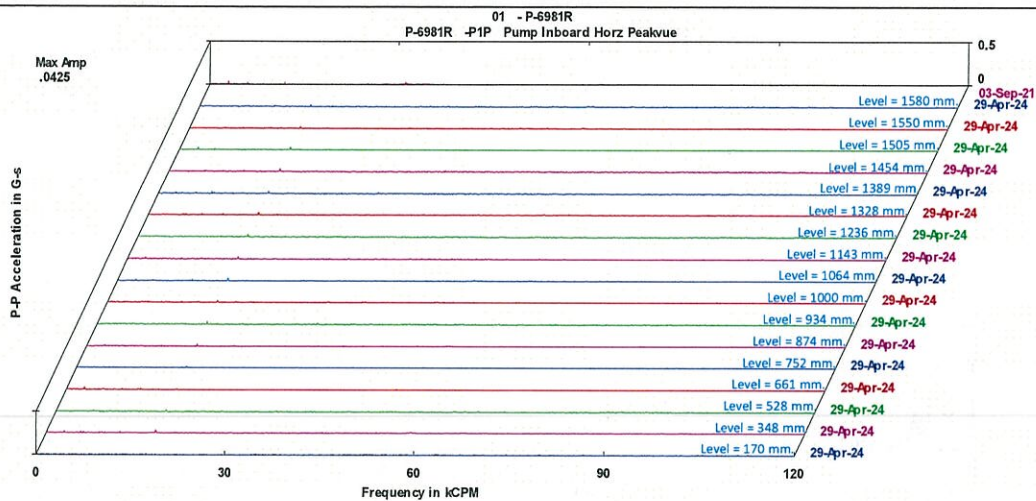


Fig4: Trend/Waterfall/Spectrum Plot Point P1: Pump – DE – Horizontal – Acceleration of Peakvue mode.

Inspection Finding

Motor:

1. The overall velocity of vibration at point M1 motor NDE in vertical direction was stable around 0.76 mm/s, RMS and enter to "GOOD" severity by refer ISO 10816-3. The FFT spectrum still showed dominant peak at 6,000 CPM (2FL) which indicate to uneven air gap and amplitude is in limit. It is normal condition. (Fig 1)
2. The overall acceleration of Peakvue mode at point M1 motor NDE in horizontal direction was stable around 0.14 G's, P-P and enter to "GOOD" severity by refer CSI Vibration Peakvue Acceleration. The FFT spectrum did not show bearing defect signal. (Fig 2)

Pump: Test low level transfer.

1. The overall velocity of vibration at point P1 pump DE in horizontal direction was stable around 0.56 mm/s, RMS and enter to "GOOD" severity by refer ISO 10816-3. The FFT spectrum shown dominant peak at 1x pump speed and its harmonic and amplitude still low. It is normal condition. (Fig 3)
2. The overall acceleration of Peakvue mode at point P1 pump DE in horizontal direction was stable around 0.14 G's, P-P and enter to "GOOD" severity by refer CSI Vibration Peakvue Acceleration. The FFT spectrum did not show bearing defect signal. (Fig 4)
3. At site did not find any abnormal noise.
4. While test pump at lowest level (170 mm.) didn't measure done all of measurement point. Due to pump was stop.

Conclusion

- **Motor:** Motor is in normal condition.
- **Pump:** Pump is in normal condition.

Recommendation

- **Motor:** Should be keep monitor trend of vibration and Peakvue mode in routine interval.
- **Pump:** Should be keep monitor trend of vibration and Peakvue mode in routine interval.