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เอกสารข้อกำหนด Jetty Regulation





## 1. GENERAL INFORMATION

## 1.1 GENERAL

The terminal is referred to as " PTT Global Chemical Terminal ". The Terminal is owned and operated by PTT Global Chemical Public Company Limited ( PTTGC ).

It is situated on the Eastern Shore of the Gulf of Thailand approximately 220 kilometers from Bangkok.

Latitude - 12° 38' 08" North.  
Longitude - 101° 08' 04" East.

The Marine Terminal consists of two berths for Importation / Exportation and Internal Distribution of Petrochemical / Chemical Products.

Berth No.1 is located approximately 4.2 kilometers off shore and connected by a pipeline jetty to Buffer Tank Farm on shore.

Berth No. 2 is extended from Berth No.1 to the Southwest side about 550 meters.

An anchorage area for the Pilot be onboard is defined at

Latitude - 12° 36' North.  
Longitude - 101° 10' East.

*This position shall be change according to the weather under the considerations of An Incharging Pilot.*

## 1.2 OFFICIAL ADDRESS

PTT Global Chemical Terminal  
PTT Global Chemical Public Company Limited  
Map Ta Phut , Rayong 21150 , Thailand.  
Telephone 66-38-994-000  
Facsimile 66-38-975-119

## 1.3 ACCEPTANCE CRITERIA

PTT Global Chemical Terminal consists of two berths. They are designed to serve vessels of various sizes and types of cargoes (see page no.24 and 25).

## 1.4 PILOTAGE

Pilots must be ordered for both inward and outward passages by the ship's agent.  
VHF channel 16 is always monitored.

The pilot uses a service boat to board arriving vessels or vessels at anchorage.

## 1.5 TIDES

HAT + 3.50 m ( Highest Astronomical Tide )  
MHHW + 3.00 m ( Mean Higher High Water )  
MHW + 2.80 m ( Mean High Water )  
MSL + 2.20 m ( Mean Sea Level )  
MLLW + 1.40 m ( Mean Lower Low Water )

LAT + 0.50 m ( Lowest Astronomical Tide )

## 1.6 TIDAL CURRENTS

- \* Pass from East to West during flood tides with mean velocities of 0.16 m/sec respectively maximum velocities of 0.34 m/sec and
- \* Pass from West to East during ebb tides with mean velocities of 0.13 m/sec respectively maximum velocities of 0.23 m/sec

These tidal current velocities are without negative influence on ships approach as well as on ships berthing, but in contrary they favour the approach and berthing manoeuvres as the currents directions are passing the loading platform's front side nearly parallel.

## 1.7 WAVES

The wind-induced waves at the loading platform are mainly from South and Southwest directions.

The Maximum Height of Waves are 2.8 meters at wave period of 8 seconds.

## 1.8 WINDS

The Predominant Wind Directions are :

- \* From the South during February to May
- \* From the Southwest during June to September, and
- \* From the North during October to January with.

Mean monthly wind speed of 13.9 km/h or 3.9 m/sec – Weak Breeze  
Mean of maximum velocity of 135.3 km/h or 37.6 m/sec –

Typhoon in November from the North.

Strong winds of more than 10 m/sec are, however very infrequent in the area as well as the occurrence of Tropical Storms.

## 1.9 WATER DEPTHS

## At Berth No. 1

Maximum Draft for Vessels arriving or departing can be stated as being 8.0 meters plus the height of the tide at that time.

The Existing Depth allowance for under keel clearance is required a minimum of 0.6 meter or 10% of vessel's draft once alongside at all times.

## At Berth No. 2

Maximum Draft for Vessels arriving or departing can be stated as being 10.5 meters plus the height of the tide at that time.

The Existing Depth allowance for under keel clearance is required a minimum of 0.6 meter or 10% of vessel's draft once alongside at all times.

## 1.10 TUGS

Tug service is arranged for by the Ship's Agent / Ship's Owner / Ship's Charterer. Tugs are required for Mooring and Unmooring Operation

One or two available fire monitors that can spray the water at least 20 meters are required for all tugs.

The number of tugs employed will vary according to the size of the vessel and prevailing weather conditions and/or according to the Notification of the Marine Department.

### Under Normal Circumstances

One tug with Engine Power at least 2,400 HP, is required for Vessels up to an overall length of 110 meters.

Two tugs with Engine Power at least 2,400 HP, are required for all type of Vessels LOA longer than 110 meters.

### In Monsoon Season

Two tugs with Engine Power at least 2,400 HP, are required for all type of Vessels to Mooring and Unmooring the Pier.

In case of Abnormal Circumstances, the number of tugs required will be under considerations of Pilot.

At least one tug with Engine Power at least 2,400 HP, must standby in the vicinity nearby at all time whilst vessel alongside.

( Except the Loaded Cargo is Nitrogen )

## 1.11 MOORING GANG

Running of mooring lines and release of mooring lines except in an Emergency is handled by mooring gang and are arranged for by the Ship's Agent / Ship's Owner.

For mooring the vessel at the Berth No.2 at least two mooring boats are required.

At least two mooring men have to standby on terminal at all time whilst vessel alongside. ( Except the Loaded Cargo is Nitrogen )

## 2. VESSELS RESTRICTIONS / REQUIREMENTS

2.1 Vessels must have been properly cleared and accepted by PTT Global Chemical Terminal.

Only such liquefied gas and chemical vessels, which comply with the recommendations of IMO and have a valid certificate relating to:-

- \* The code for existing ships carrying liquefied gases in bulk [ Resolution A.329 (IX)].
- \* The code for the construction and equipment for ships carrying liquefied gases in bulk [ Resolution A.328 (IX)].
- \* The international code for the construction and equipment of ships carrying liquefied gases in bulk (IGC) [ Resolution MSC 5 (48)].
- \* The code for the construction and equipment of ships carrying dangerous chemicals in bulk [ Resolution A.212 (VII)] may operate at the berths.

2.2 Vessel must have given proper notices through the ship's agent to the Terminal by facsimile for Terminal approval to proceed to the berth prior to arrival. The notices of arrival should contain the following :-

- a) Name and call sign of the vessel.
- b) E.T.A. to PTT Global Chemical Terminal.
- c) Vessel's particulars.
- d) Details of cargo such as quantities, etc.
- e) Details of ship's manifold including type, size and numbers.
- f) Whether the ship has external impressed cathodic protection.
- g) Certificate of fitness.
- h) Safety Management Certificate.
- i) International Oil Pollution Prevention Certificate.
- j) International Ship Security Certificate.
- k) ISPS Code : Exchange of Information Form.

2.3 Vessel must be in good state of repair and all equipment properly functioning prior to proceeding to berth. Vessel must be presented in every respect ready to Load / Unload product at temperature and pressure in accordance with notice.

**For Propylene / LPG Loading Ship (Fully Pressurized Vessel);**  
**( Propylene / LPG Loading for Gassing Up Process is included )**  
 To avoid the flashing of Liquid Propylene / LPG : Pressure in Ship's Tank must be at least 3.0 Kg/cm<sup>2</sup> before commence to receive the cargo.

**For Ethylene Loading Ship (Fully Refrigerated Vessel);**

To avoid the increasing of Ship's Tank Pressure: The Temperature in Ship's Tank must be at least -80 °C before commence to receive the cargo.

**For Ethylene Unloading Ship (Fully Refrigerated Vessel);**

Cargo Temperature and Pressure in Ship's Tank must not be more than -103 °C and 0.04 Kg/cm<sup>2</sup>. The ship have to maintain this good conditions until finish cargo unloading also.

**For Methanol Vessel,**

- Terminal required vessel equipped with full functional of Inert Gas system, cargo tanks to be reported under inert condition and O<sub>2</sub> contents must be measured and remain below 8% at all times.
- In case of Vessel not have Inert Gas system, Terminal required ship manifold to connect Nitrogen (N<sub>2</sub>) size 6" ANSI 150

**For Butadiene Vessel,**

Ship tank temperature must not be more than 32 °C by Sea water spraying At top tank



For EDC Vessel,

Ship's vapor return line manifold must be prepared and ready to connect with Terminal's vapor return line before operation commence.

- 2.4 Vessel will not be acceptable for loading / unloading unless the tanks to be Loaded / Unloaded and ship's piping are free of any liquid or vapour which would knowingly contaminate or degrade the product.

### 3. BERTHING AND MOORING INFORMATION

#### 3.1 BERTHING DETAILS

On the Jetties, the Fenders and Fendering Structures were *designed to absorb at normal working stress levels*, the energy impacted by vessels approaching the Jetty at *a maximum velocity of 20 cm/sec. and a nearly parallel approach to the berths.*

Design is based on a 9,000 DWT vessel for the Berth No. 1 and based on a 35,000 DWT for the Berth No. 2

#### 3.2 MOORING DETAILS - Berth No. 1

Max draft 8.0 meters. Max manifold height 11.5 meters.

Max berthing displacement 11,500 MT.

Vessel sizes may vary from 1,000 to 8,500 DWT with LOA 60 to 162 meters.

Six Mooring Dolphins are provided to take the Breast Lines, and the Head / Stem Lines from vessels.

The Spring Lines are led to the Two Breasting Dolphins.

The Mooring Dolphins are rigid structures consisting of circular piles with a concrete cap.

The Bollards are fixed on top of each Mooring Dolphin and Breasting Dolphin.

The Bollards are capable of withstanding a stress of 50 tons each.

#### 3.3 MOORING DETAILS - Berth No. 2

Max draft 10.5 meters. Max manifold height 12.5 meters.

Max berthing displacement 42,000 MT.

Vessel sizes may vary from 8,000 to 35,000 DWT with LOA 90 to 270 meters.

*The Mooring Dolphins* (MD-51 and MD-52) are each fitted with 150 tons capacity quick release mooring hooks.

MD-53 and MD-54 are each fitted with 100 tons capacity quick release mooring hooks.

MD-55 and MD-56 are each fitted with 50 tons bollards.

*The Breasting Dolphins* (BD-51 and BD-52) are equipped with 70 tons bollards. The middle breasting dolphin (BD-53) is fitted with 35 tons bollard

#### 4. BERTHING OPERATION AND TERMINAL FACILITIES

##### 4.1 BERTHING PROCEDURE

- Berthing/Unberthing is permitted both daytime and nighttime. The government pilot will board the vessel at anchorage area and will assist the Master in manoeuvring the vessel to berth.
- One or two tugs of adequate power (see item 1.10) will normally assist the Vessel in Berthing / Unberthing. They will also standby in the vicinity nearby and ready to take the Master's or PTT Global Chemical Loading Master's order regarding abrupt change in weather condition.
- One or two mooring boats are used to send lines ashore.

##### IMPORTANCE NOTICES

- In the event of excessive high wind and/or disruptive sea condition, it shall be the decision of PTT Global Chemical Loading Master to allow docking to proceed. When such circumstance is deemed to become unsafe for berthing it shall be his authority to terminate docking activity. Cost arisen from such a case of vessel to be moored at the terminal either actual or calculated as business interruption shall not become accountable among parties involved.
- All mooring equipment and lines must be in top working condition.
- Synthetic tails without proper connection or spliced mooring lines are not allowed
- Mixed mooring are occasionally acceptable as long as they are not used in the same direction or points.
- While manoeuvring for berthing PTT Global Chemical Terminal, it is very essential that the vessel's engine performs promptly and accurately. It is recommended that trial engine manoeuvres are tested before the vessel goes to the berth.
- Self tension winches fitted with automatic rendering and hauling should not be used in automatic mode while the vessel is moored. This is because they may not always hold in position while at berth.
- A sufficient number of personnel to deal with an emergency must present on board the vessel at all time during the vessel's stay at berth.
- While the vessel is at berth, her boilers, main engines, steering machinery and other equipment essential for manoeuvring should be maintained in condition that will permit the vessel to move away from the berth at short notice.
- All vessels while lying alongside PTT Global Chemical Terminal must strictly follow the terminal's rules and regulations.
- The maximum permissible drift parallel to the platform about the center of the appropriate Loading / Unloading Hose or Arm is 1.0 meter.
- In case of the Rubber Fender was damaged due to an Abnormal Berthing and /or The Rubbing Board was damaged due to scratching with the Ship's Water Draining Line which protrude from Ship's port or starboard side. The Terminal reserve the right to hold the Vessel / Owner fully responsible for all expenses occurred from the above matter.

#### 4.2 WIND SPEED LIMITATION FOR LOADING ARM OPERATION

As safety operating procedure, when the terminal wind indicator indicates the wind is blowing at 18 m / sec. or more from any direction the terminal will take the following precautions actions

- Inform Vessel's Personnel to be alert on moorings
- Stop Discharging / Loading
- Drain Loading Arms.
- Disconnect Loading Arm.

The said limitation is to ensure that the disconnection of loading arms will be completed before the wind speed reaches the maximum limitation for operating conditions of the loading arms ( 21 m / sec.)

#### 4.3 EMERGENCIES

##### a) Emergency Shutdown System ( E.S.D.)

The berth is equipped with the E.S.D. System.

In an emergency, the operator can push a single button to stop loading operations ( and obviously ) the discharging operations at the berth.

This button will stop shore's loading pumps and close all valves concerned.

It is imperative that a constant watch is maintained on dock while discharging.

In case the emergency shutdown is activated,

Vessels have to stop immediately all cargo pumps.

##### b) Emergency Release Coupling ( E.R.C.)

All the loading arms are equipped with the emergency release coupling ( E.R.C. ) system which hydraulically allows disconnection of arm flanges from ship's manifolds in the following cases :-

- When loading arm travels over the disconnection alarm point.
- When the emergency disconnection button is pressed at the loading arm control console on the gangway tower.

In the event of mishaps the loading will be stopped by emergency shutdown sequence. The closing speed (5-30 seconds) is controlled to restrict surge pressure after disconnection, the loading arm will be returned to safety area and will be locked

#### 4.4 SHIP'S MANIFOLD REQUIREMENTS

No vessel's flexible hoses are allowed for connection with loading arms. Since the berth is equipped with loading arm of various types and sizes, therefore they should be used in accordance with their own operating limits. Loading arms limitations and cargo hoses limitations are shown in item 9.2 and 9.3 successively.

Due to limitation of working area of loading arms shown on page 26,27 and 28, the level of ship's manifold must be maintained to be lower than 11.5 meters and higher than 3 meters from water level during loading or unloading the cargo.

If the vessel's manifold is unfit to our loading arms after all possible attempts, we will accept no responsibility.

#### 4.5 GANGWAY

Gangway was installed on Berth No.1 It consists of gangway, bulwark ladder and turntable. Length of gangway is adjustable in order to be operated more safely. Hooking up and down of gangway is performed by jib crane.

##### OPERATION CONDITION

###### *Weather conditions*

Max. wind speed in operation 10 m/sec.

###### *Vessel conditions*

Max. deck height 0.75 meters lower than the platform level

Min. deck height 9.55 meters lower than the platform level

###### *Gangway load conditions*

Gangway 5 persons

Bulwark ladder 2 persons

( Assuming 75 kgs / person )

##### RESTRICTION

- \* When operating gangway, it is strictly prohibited to place persons and/or objects on it.
- \* Loading limit must be kept strictly.
- \* On operation of gangway the maximum number of persons on bridge at one time must be 5 persons
- \* When any danger is supposed due to strong wind, gust and others, do not operate.
- \* Roughly walking on bridge should be prohibited and resonance by walking should be prevented.
- \* Turntable must be moved to the direction of sea without fail when operating the gangway.

#### 4.6 CATHODIC PROTECTION

Impressed current cathodic protection system, if fitted , must be switched off at least three hours before mooring operations

#### 4.7 FIRE FIGHTING EQUIPMENT

The fire fighting system at the jetty consists of elevated and tele controlled monitors. There are two monitors installed on the Berth No.1, one at the

monitor tower and one at the gangway tower. The monitors are mounted at a sufficient elevation to cover the manifold from the smallest vessel at fully loaded ( lowest tide ) and the largest vessel at light condition ( highest tide ).

One monitor was installed on the Berth No. 2 at the monitor tower.

The monitors and the fire pumps are remote controlled and can be used with foam and / or water compound At Berth No. 1, the monitors can also be used with dry powder.

Fixed water spray systems are provided for both monitor towers and gangway tower in order to protect them from heat radiation.

Several hydrants, portable fire and dry powder extinguishers are installed on operating platform. All tugs are fitted with fire fighting monitors for both water and foam.

## 5. CARGO CALCULATIONS, OPERATIONS AND EMERGENCY PROCEDURE

### 5.1 CARGO CALCULATIONS

Sampling, Ullaging and Quantity Calculations will be carried out after berthing concurrently with Immigration and Port Health Authority Formality or concurrently with the connection of Loading Arm. The calculations procedure will be attended by Custom Officials and Terminal's Representative.

### 5.2 SAFETY AND POLLUTION CHECK LISTS

Ship / Shore safety and pollution check lists are to be completed jointly between vessel and terminal representative prior to load or discharge. The loading master will coordinate cargo operations between the vessel and shore.

## 5.3 LOADING / UNLOADING CONDITIONS

Product	Activity	Max.Flowrate	Max.Pressure	Temperature
Propylene	Unloading	550 m3/hr.	16.0 kg/cm2	>0°C
	Loading	380 m3/hr.	16.0 kg/cm2	Ambient
	Gassing-Up		Up to Ship's Request	
Butene-1	Unloading	150 m3/hr	12.0 kg/cm2	>10°C
	Loading	150 m3/hr.	10.0 kg/cm2	Ambient
LPG	Loading	375 m3/hr.	20.0 kg/cm2	Ambient
	Gassing-Up		Up to Ship's Request	
	Unloading	500 m3/hr.	5.0 kg/cm2	-103°C (or Lower)
Ethylene	Loading	300 m3/hr.	2.0 kg/cm2	-96 °C (or Lower)
	Gassing-Up		Up to Ship's Request	
C4R (Raffinate)	Loading	320 m3/hr.	10.0kg/cm2	Ambient
EDC (Berth1)	Unloading	240 m3/hr.	7.0 kg/cm2	Ambient
EDC(Berth2)	Unloading	240m3/hr	7.5kg/cm2	Ambient
VCM (Berth-1)	Unloading	225 m3/hr.	12.0 kg/cm2	>10°C
	Loading	225 m3/hr.	7.0 kg/cm2	Ambient
VCM (Berth-2)	Unloading	225 m3/hr.	12.0 kg/cm2	>10°C
	Loading	170 m3/hr.	8.0 kg/cm2	Ambient
Mix C4	Loading	180 m3/hr.	10.0 kg/cm2	Ambient
1,3 Butadiene	Loading	300 m3/hr.	3.5 kg/cm2	5-10 degree C
Nitrogen	Purging	550 Nm3/hr.	8.5 kg/cm2	Ambient
	Unloading	150 m3/hr	6 kg/cm2	Ambient
MEG(Berth1)	Load	200 m3/hr	2kg/cm2	Ambient
MEG(Berth2)	Unloading	150 m3/hr	6 kg/cm2	Ambient
	Load	180 m3/hr	2kg/cm2	Ambient
Methanol(Berth1)*	Unloading	190 m3/hr	6 kg/cm2	Ambient
Methanol(Berth2)*	Unloading	190 m3/hr	7 kg/cm2	Ambient

\*Methanol product required full control of O2 contents below 8% at all times

#### 5.4 CARGO OPERATION REQUIREMENTS AND RESTRICTIONS

Following requirements and restrictions must be strictly complied with during discharge at PTT Global Chemical Terminal.

- Ensure that no water is pumped into the shore lines. All ship sea suction valves must be closed and sealed before discharge.
- Ship dirty ballasting is not allowed during discharge however, only separate ballast tanks may be used.
- Deballasting may be discharged to the sea and it is the Master's responsibility to ensure that his ballast is clean.
- Ship's mooring conditions.
  - It is the ship's responsibility to maintain a safe mooring at the berth at all times.
  - The tension of mooring lines must be tight, and they must be fastened to the satisfaction of the Loading Master.

Any unsafe mooring equipment or conditions will result in discontinuing cargo operations and possible loading arms disconnection. The time lost and cost of loading arms disconnection will be for the ship's account.

- The offshore anchor is always required while approaching the berth. The anchor should not be less than 4-6 shackles in the water.

In the event of unsafe mooring situation created by ship's negligence or by weather conditions, tug boat(s) might be necessary for assistance as deemed by the Loading Master.

*The cost of the tug boat (s) will be for the ship's account.*

- During Cargo Operations : Ship must take responsibility to maintain Ship's Tanks Pressure/Temperature by running Ship's compressor(s) or any equipments in order to keep maximum transfer rate in the best condition or *take any actions as requested by Loading Master*

After shutdown or stop transferring : Terminal must drain the product that remains in Loading Arm to Ship or Ship must take any actions as requested by Loading Master to disconnect Loading Arm properly.

- Stop cargo pumps.
- Close ship's manifold valve.

#### 5.5 EMERGENCY

In case of fire on board , discharging / loading operations must be stopped immediately.

General alarm should be given to the terminal for terminal's assistance to vacate the berth.

In case *the ship moved away from original mooring position*,

the following procedure should be conducted to protect the Loading Arms from being damage :

- Stop cargo pumps.
- Close ship's manifold valve.

- Promptly utilize tug boat(s) for pulling / pushing the vessel in windward direction.
- Activate E.R.C. to release loading arm.

#### *In the event of fire ashore*

- \* All loading / unloading and / or ballasting operations must be stopped immediately.
- \* Close all tank openings and batten down.
- \* Prepare vessel for immediate departure.
- \* Await instruction from shore

#### *Emergency escape*

- The vessel's offshore life boat shall be rigged ready for immediate lowering as an emergency escape.
- A pilot ladder shall be rigged or positioned on the outboard side of the vessel ready for immediate lowering as a means of escape in the event of an emergency.
- The PTT Global Chemical Fire Fighting Water Monitors, controlled from the Jetty Control Room Panel, will give a water spray cover to vessel's gangway in event of them being required as a Means of Escape in a fire situation.



## 6. SAFETY REGULATIONS

The following regulations must be strictly followed by all vessels whilst alongside at the terminal.

### 6.1 NO SMOKING

Smoking on board the vessel may only take place in places specified by the Loading Master. Smoking outside the designated area is strictly prohibited. Cigarette butts must not be thrown over board or through the port holes. At any time, no match or lighter will be carried on the weather deck of the vessel.

### 6.2 SPARKS

While the vessel is at berth, boiler tubes must not be blown and every precaution must be taken to see that sparks do not at any time escape from the funnel. Should sparks and / or incandescent material be observed coming from the funnel, the discharge will be stopped until such offense ceases.

### 6.3 RADIO AND RADAR

The use of the radio transmitters using the main aerials is strictly forbidden while the vessel is at berth. Repairing of radio and radar equipment may be permitted subject to the prior permission from the Terminal.

### 6.4 USE OF SHIP'S GALLEY

Certain types of galley stoves are considered safe to use if mutually agreed between the Master and the Loading Master.  
*Oil-fired galley stoves are prohibited in all cases.*

### 6.5 AIR CONDITIONING UNITS

For safety it is preferable that the air conditioning units recirculate the air within the accommodation. The drawing of air from outside the accommodation may be permitted only provided that the Master and Loading Master agree that there is no danger. Should any gas be detected within the accommodation or there may be any danger of gas being drawn in, stop the units and close the intakes.

*The window type air conditioners are forbidden at all times.*

### 6.6 READINESS TO MOVE

While the vessel is at berth, the main engine and auxiliaries that are essential for moving the vessel must remain in state of readiness in order to permit vacating the berth at short notice. No repair which will interfere with this requirement will be allowed. Should it be necessary to repair or overhaul the main engine or auxiliaries, such work must be done at the anchorage either before or after discharge.

## 6.7 VESSEL'S FIRE FIGHTING EQUIPMENTS

These equipments must be in constant readiness at all times with sufficient people on board for efficient operation.

## 6.8 SHIPBOARD WORK CONTROL

Shipboard work while the vessel is at berth must be closely observed. Approval must be obtained in advance from the Loading Master for any maintenance work, repairs, renewals, and including the following :

- a) Work that could effect the performance of the ship's main engines, deck steam / or fire fighting equipment.
- b) Inert gas system.
- c) Cargo pumping equipment, cargo tank cleaning equipment.
- d) Ballasting facilities.
- e) Mooring facilities.
- f) Any work whatsoever concerning shipboard safety control or radio.
- g) Any " HOT WORK " whatsoever.

*It remains the responsibility of The Master to ensure that the work can be safely undertaken.*

## 6.9 POSITION OF SHIP'S TANK HATCHES

For All Chemical Tankers : All Tank's Hatches have to fully close during all Cargo Operations and during Ship's alongside at Terminal.

## 6.10 SLIP TUBE GAUGE

The use of slip tube gauge for level reading of cargo tank is prohibited, granted only for emergency case.

## 6.11 SECURITY

*No unauthorized visitors including local traders are allowed on board a vessel during the time moored at PTT Global Chemical Terminal. Failure to follow this rule will be considered as a serious violation of our safety regulations and Discharging / Loading Operations will be suspended.  
Any time lost will be for the Ship's Account.*

Authorized visitors are Government Officials, PTT Global Chemical's Staff, Ship's Agent representative and PTT Global Chemical's Contractors.

PTT Global Chemical 's Staff and PTT Global Chemical 's Contractors will be identified with appropriate badge.

All ship's crews are not allowed to leave from the ship by entering the Terminal. The small boat(s) provided by Ship's Agent is required for the crew(s) who wish to go ashore. Crew lists approved from the Ship's Master / Ship's Agent and Immigration Documents (TM-33) have to lodge to Loading Master first. The permission to leave is belonging to Loading Master.

Except the ones who have the medical requested that generates by the Ship's Master. In this case the crew(s) can go to see the doctor within the responsibility of Ship's Agent by shore's tram car.

*The small boat is not allowed to alongside with vessel.*

*The small boat will berth at the small boat platform.*

Failure to follow this rule will be considered as a serious violation of our safety regulations and Discharging / Loading Operations will be suspended.

*Any time lost will be for the Ship's Account.*

Sign on / Sign off crew(s) naming list and copy of all passport books are to be lodged to the Terminal by ship's agent before the arrival of a vessel.

This will prevent inconvenience should any changing crew wish to enter and leave the Terminal in the interest of safety and security.

*The entry of women to the Terminal is restricted.*

Female members of a vessel's crew and wives of crew members who will be allowed to access only if they are in possession of a pass signed by the Master of the vessel and countersigned by the Appropriate Ship's Agent.

The Co-operation of the Masters and Ship's Agent is requested in the interest of safety.

It shall be a recognized gangway of approved pattern as means of access to a vessel. Provided it maintains a steep inclination and is properly secured and tended. A safety net shall at all time be in position and should be properly secured and tended.

A noticeboard shall be displayed in a prominent position near to the access to the vessel indicating

" No Admittance, Except On Business "

" No Smoking Allowed "

## 7. PREVENTION OF SEA POLLUTION

7.1 The Vessel's Master will always be responsible to ensure that no product or bilge shall be discharged or spilt into the sea. In the event of any discharge or spillage from the vessel the Master will without delay take all reasonable measure to contain or remove product and to minimize or mitigate damage to private and public properties or interests, including sea life.

7.2 Without prejudice to the foregoing the terminal reserves the full right to take, without consent of the Vessel's Master, any measures it considers necessary to contain or remove product discharged or spilt from the vessel and to minimize or mitigate damage to private and public properties or interests, including sea life.

*All costs and expenses incurred therefore by the Terminal shall be borne and promptly refunded by the Vessel's Owners.*

## 8. BUNKERING, STORING AND VICTUALLING OF VESSELS

### 8.1 No bunkering facilities are provided on the Terminal.

8.2 Bunkering, storing and victualling of vessels may be permitted during operations but only with permission of both the Loading Master and the Master of the Vessel provided that:

- i) Access to the Terminal is not obstructed.
- ii) Cargo operations remain adequately supervised.
- iii) Cargo operations which may allow vapours to escape on deck e.g. sampling, ullaging, deflexing etc. are suspended.
- iv) Drums of oil, paint, steel plates, gas cylinders or any other heavy metal parts which may cause a spark should be landed on rubber or other suitable matting and not directly onto vessel's deck. These items must not be dragged or rolled along the deck.
- v) If an oil spillage occurs, the oil shall be disposed of by mopping up or by a method agreed by PTT Global Chemical's representative. Drip trays must always be used when pipeline connections are broken. Under no circumstances shall oil be washed overboard.
- vi) The platform crane is for hose-handling and other purposes. It may only be operated by the Terminal personnel and may only assist in loading items of stores provided that they are within the safe working limit of the crane and the Terminal personnel is available to operate without detriment to his other duties.
- vii) The appropriate document indemnifying PTT Global Chemical against all accidents has been signed.
- viii) The designated point for setting down of vessel's store is at the discretion of the Terminal personnel.
- ix) If the above criteria are not met, PTT Global Chemical reserves the right to refuse permission.

- x) The appropriate document indemnifying PTT Global Chemical against all accidents has been signed.
- xi) The designated point for setting down of vessel's store is at the discretion of the Terminal personnel.
- xii) If the above criteria are not met, PTT Global Chemical reserves the right to refuse permission.

### 8.3 SUPPLY VESSEL'S ALONGSIDE

*No supply vessels are allowed alongside.*

*All supply vessels used for victualling will berth at the small boat platform.*

### 8.4 BATHING AND FISHING

Bathing and fishing will not be permitted from the platform and approaches or from the vessel whilst alongside.

## 9. BERTHS CHARACTERISTICS AND CARGO ARMS OPERATING LIMITS.

### 9.1 BERTH CHARACTERISTICS

Characteristics	Max berthing Displacement (MT)	LOA.( Meters)	CARGO
Berth No.1	11,500 ( Max )	162 ( Max ) 60 ( Min )	Propylene Butene-1 LPG Butadiene Ethylene EDC VCM Methanol Nitrogen MEG Mix C4 Raffinate
Berth No.2	42,000 ( Max )	270 ( Max ) 90 ( Min )*	EDC VCM Methanol MEG Propylene Butene-1 Mix C4 Raffinate

\* Smaller or Larger Vessels may be accommodated . However, Special approval must be obtained prior to scheduling

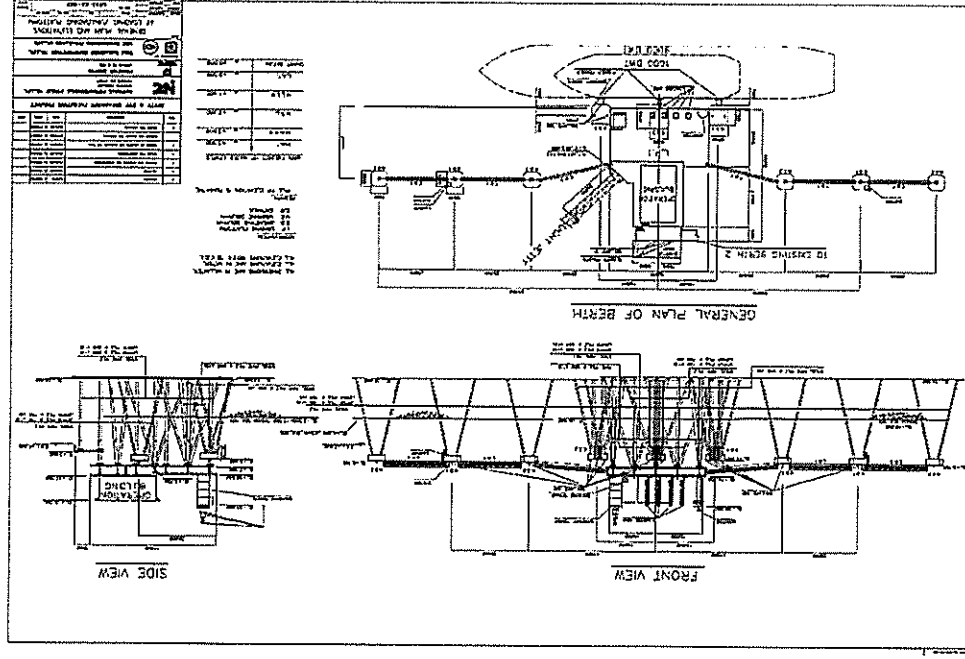
## 9.2 LOADING ARMS LIMITATIONS

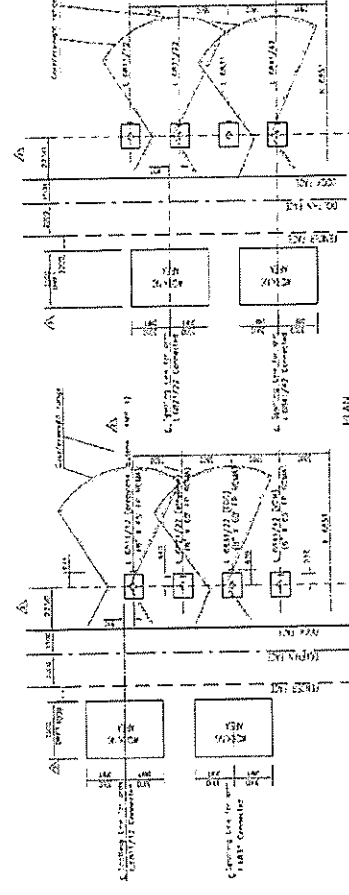
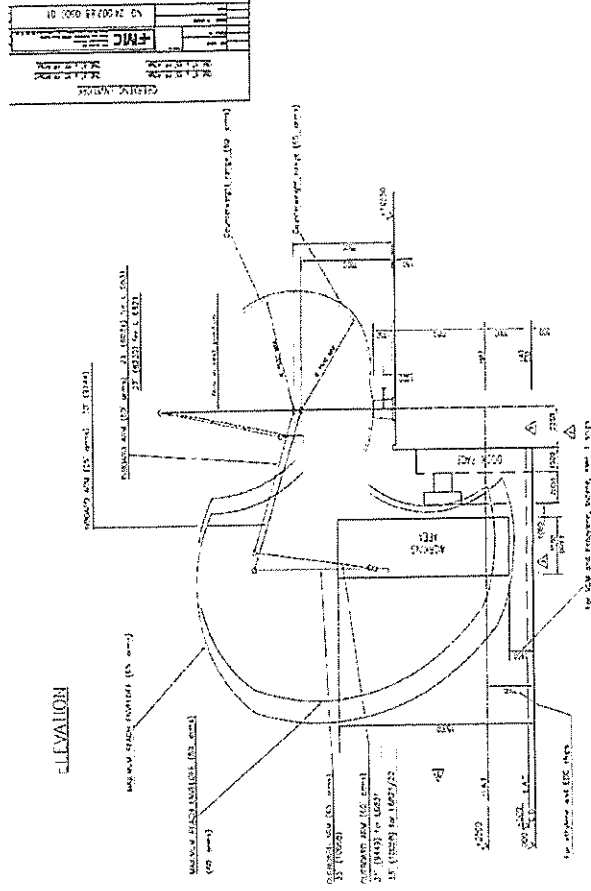
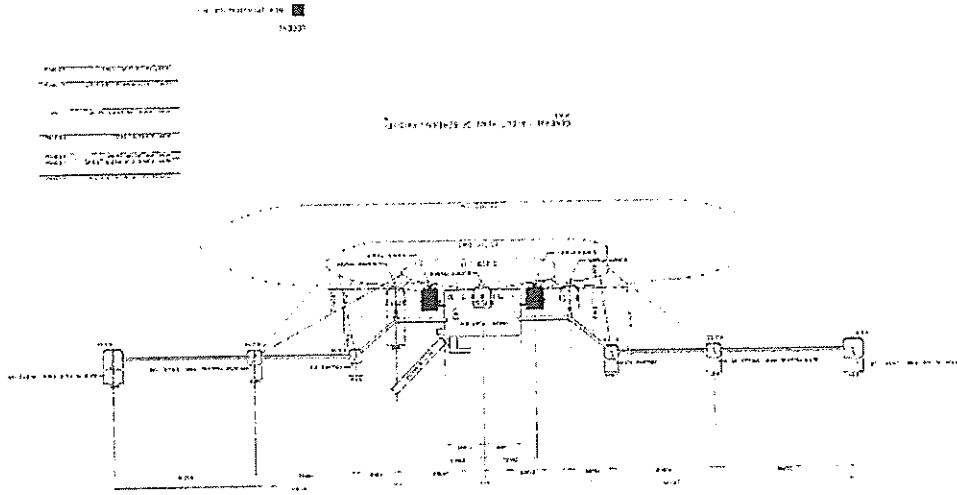
Products	Size of Ship's Flanges (Inches)	Type (ANSI)
Propylene, Butene-1, MixC4, LPG, Raffinate (Berth1)	8 x 1	300 RF
Liquid	4 x 1	300 RF
Vapour		
Ethylene	8 x 1	150 RF
Liquid	3 x 1	150 RF
Vapour		
EDC(Berth1,2)	8 x 1	150 RF
Liquid	6 x 1	150 RF
Vapour		
VCM (Berth-1,2)	6 x 1	150 RF
Liquid	3 x 1	150 RF
Vapour		
Butadiene(Berth1)	8 x 1	300 RF
Liquid	4 x 1	300 RF
Vapour		

## 9.3 CARGO HOSES LIMITATIONS

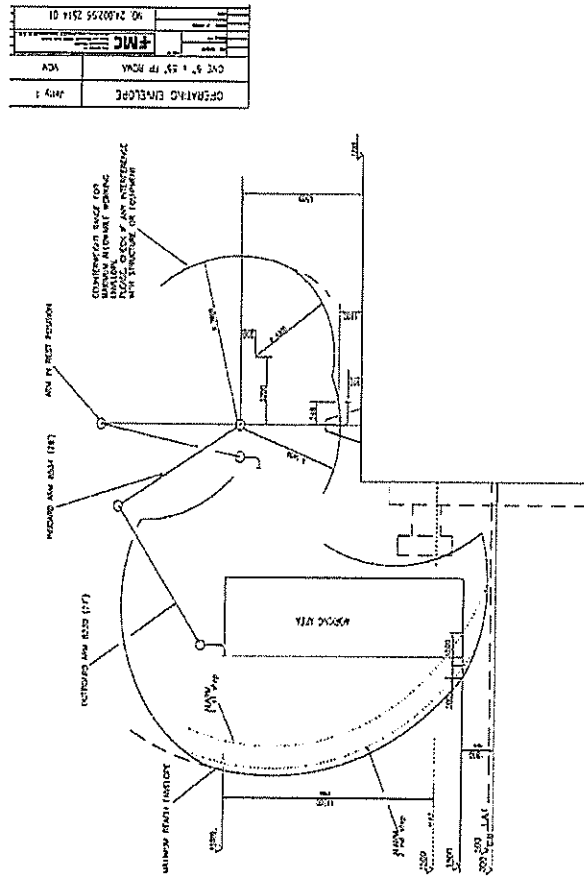
Products	Ship's Flanges Size (Inches)	Type (ANSI)	Hose Diameter (Inches)	Hose Length (Meters)	Hose Material
MEG	6 x 1	150 RF	6	18	Polypropylene
Methanol (Berth-1,2)	6 x 1	150 RF	6	18	Polypropylene
EDC (Berth1,2)	6 x 1	150 RF	6	18	Polypropylene

## Berth No. 1

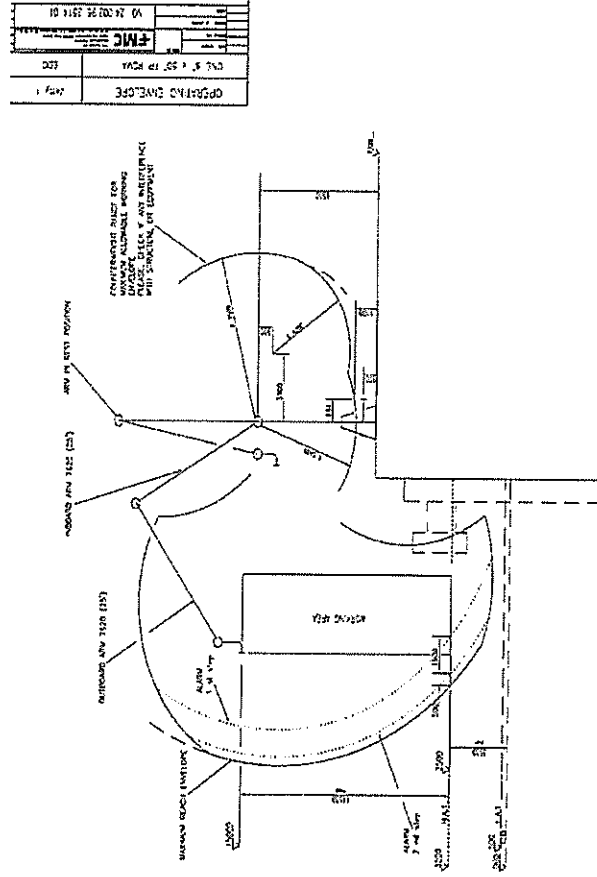
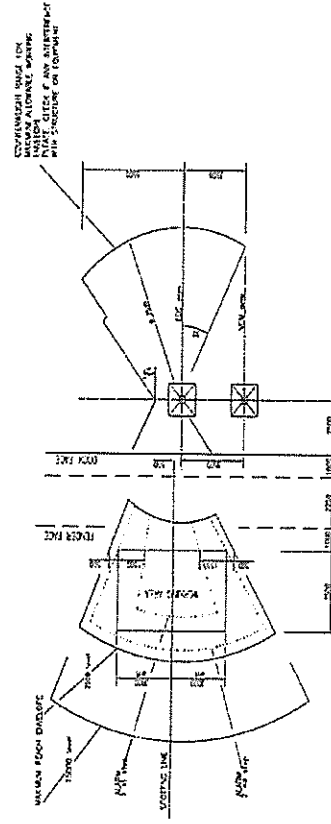
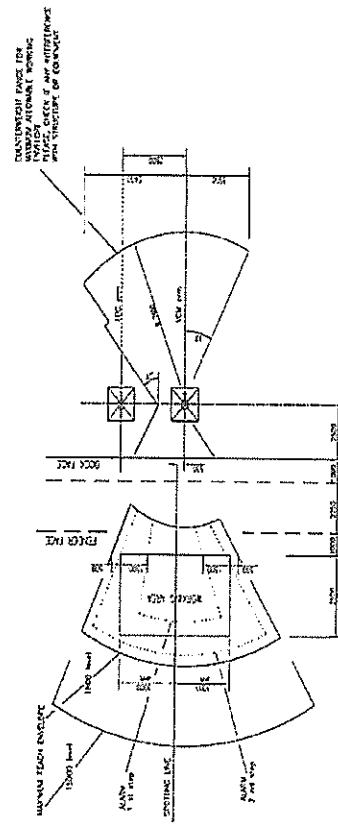








OPERATING EMPLOYEE		ONE 3' x 3' RP ROOM		VCA	
				10 152 5628072 ON 10 152 5628072 ON	

[illegible]

WORKING AREA OF VCM LOADING ARM ON BERTH NO. 2

WORKING AREA OF EDC LOADING ARM ON BERTH NO.

➤ 9๒

เอกสารผลการตรวจสอบการสิ้นสะท้อน  
ของเครื่องจักร





**ประจำเดือน มกราคม 2568**





# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**  
**Month of Survey and Data Collection: January 2025**

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

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 14 and 27 January 2025

Measurement plan 93 Equipment.

Checked 13 Equipment.

Machine did not operate 80 Equipment.

As show in Fig 1 And Table 1

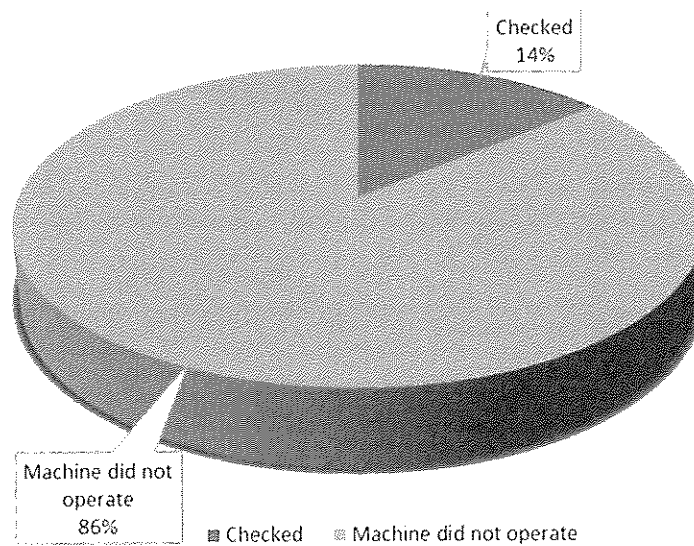
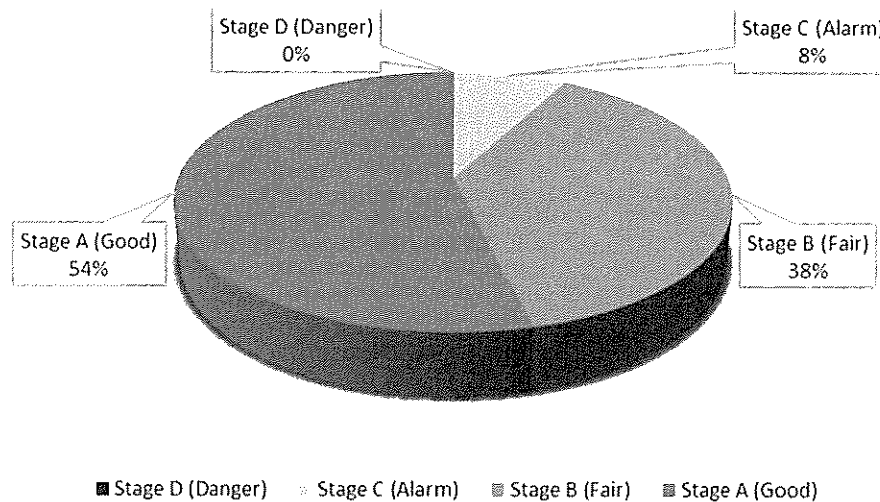


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	13	80	93
Percentage	100%	14%	86%	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	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	1	5	7	13
Percentage	0%	8%	38%	54%	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 10-1000 Hz, > 600 rpm 2-1000 Hz, > 120 rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
> 11.0	A	B	A	B	A	B	A	B
11.0 - 11.0	A	B	A	B	A	B	A	B
7.1 - 11.0	A	B	A	B	A	B	A	B
4.5 - 7.1	A	C	C	B	A	C	C	B
3.5 - 4.5	C	B	B	A	C	B	B	A
2.8 - 3.5	C	B	B	A	C	B	B	A
2.3 - 2.8	B	B	B	A	B	B	B	A
1.6 - 2.3	B	A	A	A	B	A	A	A
0.7 - 1.6	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

 Newly Commissioned  
 Unrestricted long-term operation  
 Restricted long-term operation  
 Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	≤ 0.56	> 0.56 - 1.41	> 1.41 - 5.08	> 5.08
1000	≤ 1.13	> 1.13 - 2.82	> 2.82 - 9.87	> 9.87
1500	≤ 1.68	> 1.68 - 3.95	> 3.95 - 11.28	> 11.28
3000	≤ 3.95	> 3.95 - 8.46	> 8.46 - 28.2	> 28.2

#### 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: **Stage D (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: **Stage C (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: **Stage B (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	
>14-2.8	>23-4.5	>23-4.5	>35-7.1	>14-2.8	>23-4.5	>23-4.5	>35-7.1	

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: **Stage A (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 2025				
No.	Tag No.	Severity	Conclusion	Recommended
1	N-P-6871R	Stage C (Alarm)	<u>Stage C (Alarm) new entry.</u> <b>Engine:</b> Normal condition. <b>Gearbox/Pump:</b> Pump had misalignment problem. (Possible to coupling and DBSE abnormal.)	<b>Engine &amp; Pump:</b> 1. Should be consider stop P-6871R to standby mode and action as below step. 2. Should be check coupling include rubber joint condition. If found damage should be replace new. 3. Should be recheck DBSE. If found over limit <u>by refer OEM</u> should be adjusted. 4. Should be re-alignment with high accuracy <u>by refer OEM</u> . 5. <u>Short-term</u> , should be keep monitor trend of vibration and Peakvue mode in <u>bi-weekly interval</u> .

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.



## Vibration analysis report for GC7\_BTF Plant



Tag: N-P-6871R

Machine name: FIRE WATER PUMP

Inspected by: Natdanai T.

Severity: Stage C (Alarm)

Date of data measurement: 14 January 2025

Analyst by: Warut K.

Area: GC7\_BTF

Main problem: Routine. Pump had misalignment problem. (Possible to coupling and DBSE abnormal.)

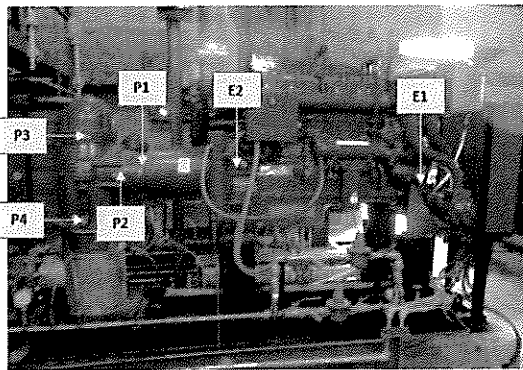
Review by: Warut K.

### Reference criteria

Standard		Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)	Unit
ISO-10816 part 6 (Engine)	Class V	$\leq 14.1$	$> 14.1 - 28.2$	$> 28.2 - 44.6$	$> 44.6$	mm/S RMS
Statistical alarm Acceleration of Peakvue mode		$\leq 10.5$	$> 10.5 - 16.4$	$> 16.4 - 18.5$	$> 18.5$	G's, Pk-PK
Statistical alarm velocity of pump		$\leq 27.9$	$> 27.9 - 55.9$	$> 55.9 - 74.6$	$> 74.6$	mm/S RMS

Remark: ISO-10816 provides specific guidance for assessing the severity of vibration measured on machine in steady state, thus GCME will consider the magnitude of vibration, the changes in the magnitude and frequency for judging the severity of vibration.  
Statistical alarm was calculated from historical measurement more than 10 times.

### Machine description and vibration measurement point



#### Engine

Manufacturer: CATERPILLAR

Type: DIESEL (CAT 3406C)

Power: 217-359 kw

Speed = 1,750-2,300 rpm

DE Bearing: N/A

NDE Bearing: N/A

#### Pump

Manufacturer: Bombas vertical gear pump

Type: N/A

Shaft input speed (P1, P2): 1,750-2,300 rpm

DE Bearing:

NDE Bearing:

Shaft output speed (P3, P4): N/A

DE Bearing: N/A

NDE Bearing: N/A

Tooth of Gear /High speed: N/A

Tooth of Gear /Low speed: N/A

GMF1 = N/A



# Vibration analysis

## Engine

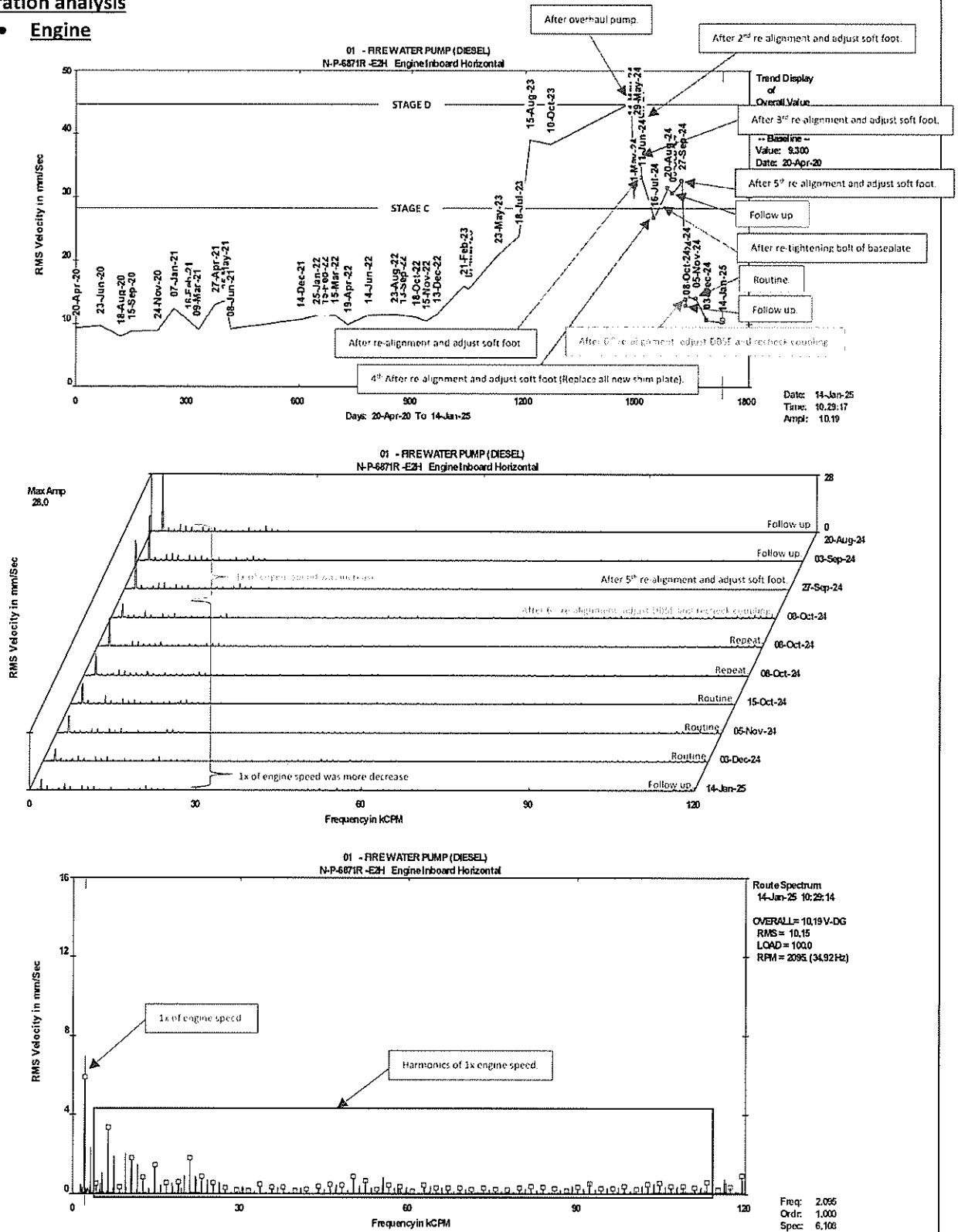


Fig1. Trend/Waterfall/Spectrum Plot Point E2: Engine – DE – Horizontal – Velocity.

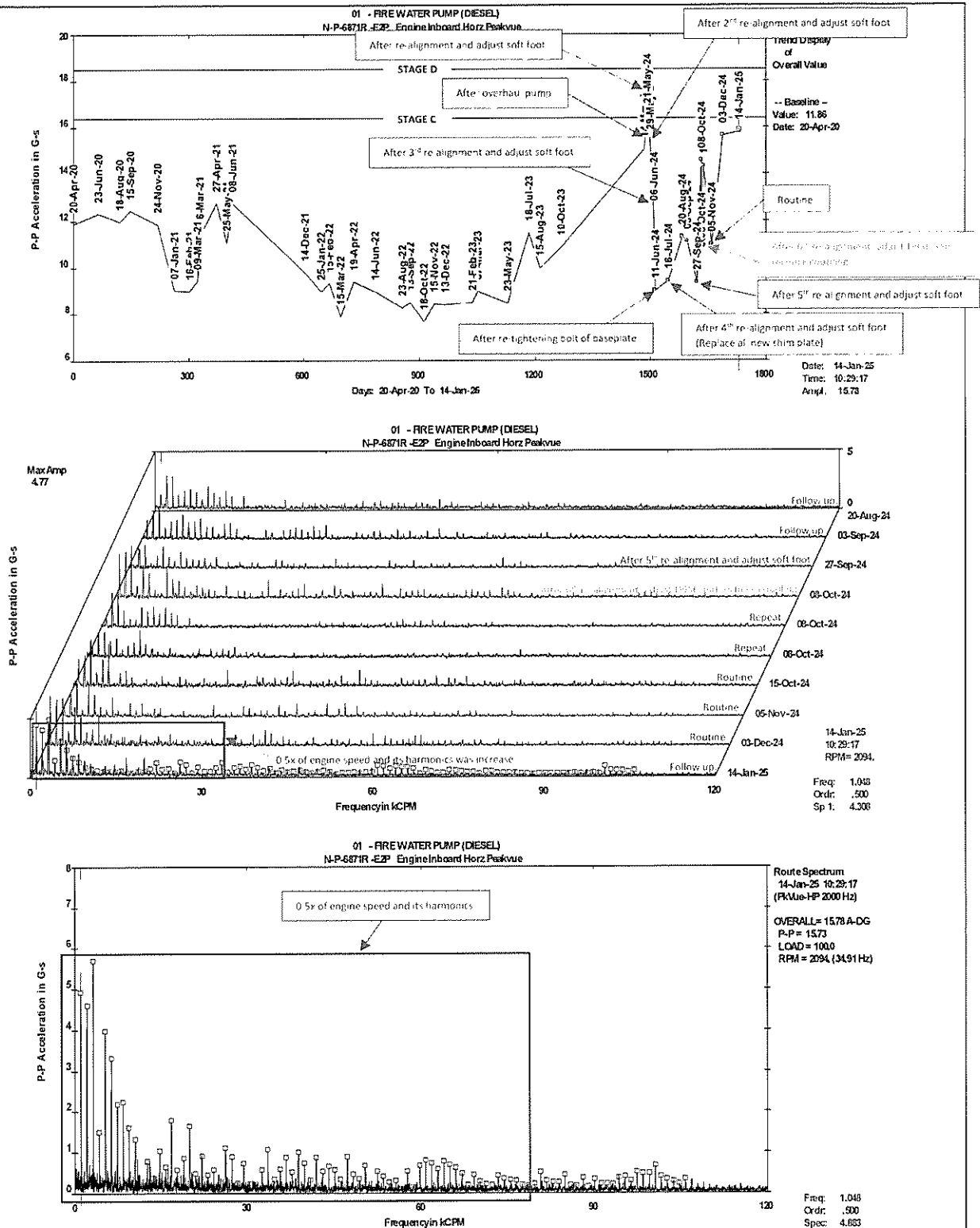


Fig2. Trend/Waterfall/Spectrum Plot Point E2: Engine – DE – Horizontal – Acceleration of Peakvue mode.

• **Pump**

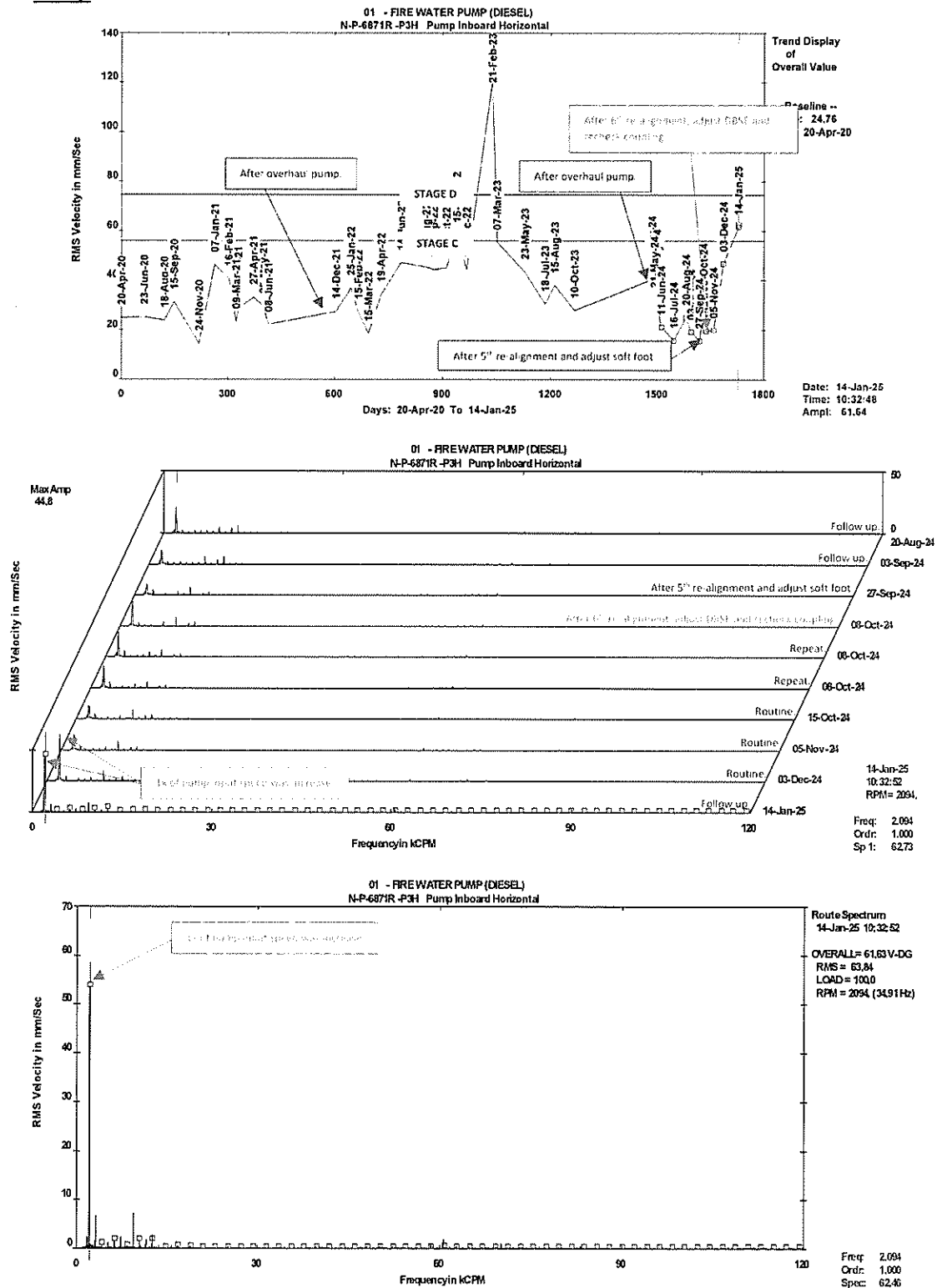


Fig 3. Trend/Waterfall/Spectrum Plot Point P3: Pump – Output shaft - DE – Horizontal – Velocity.

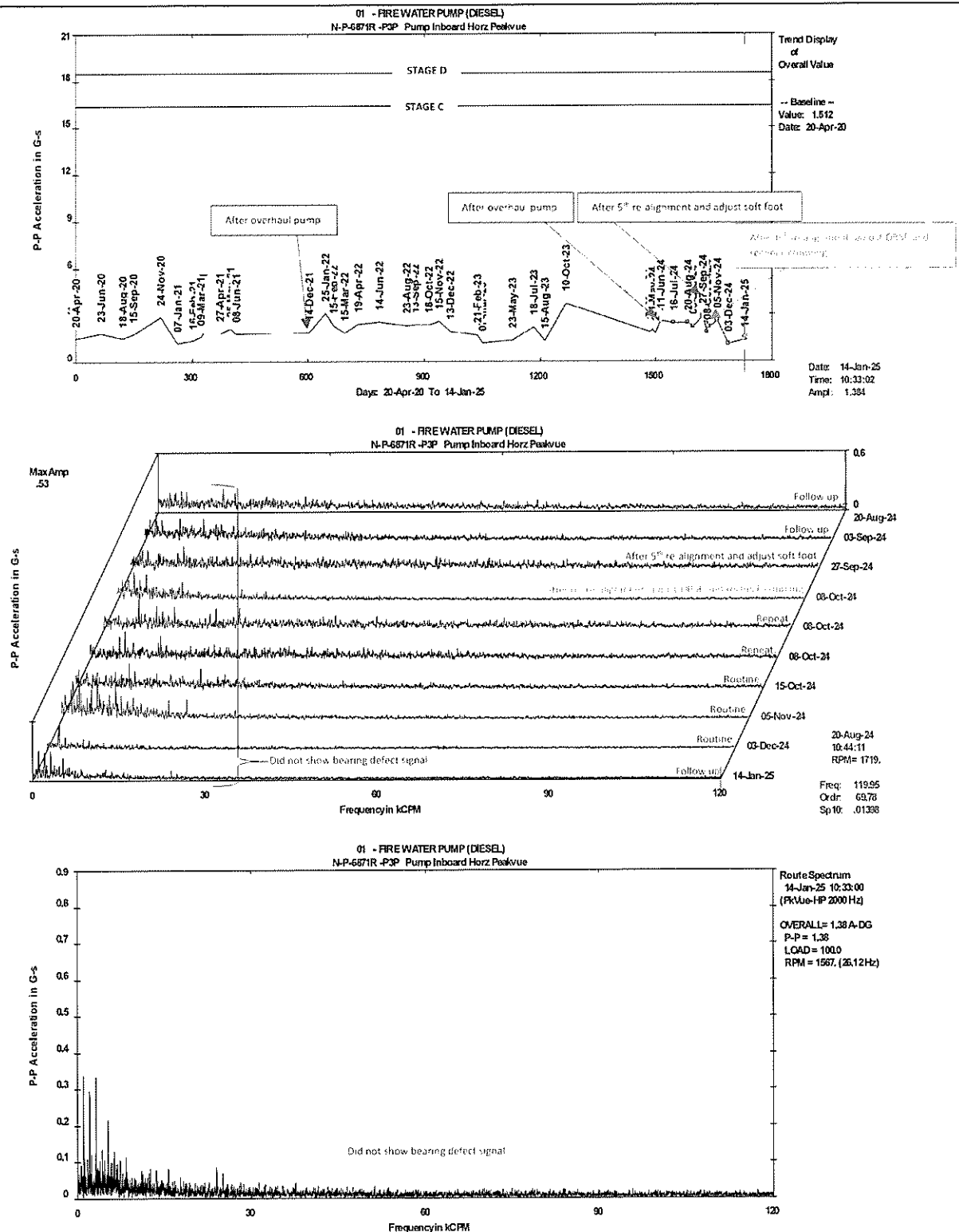


Fig 4. Trend/Waterfall/Spectrum Plot Point P3: Pump – Output shaft - DE – Horizontal – Acceleration of Peakvue mode.

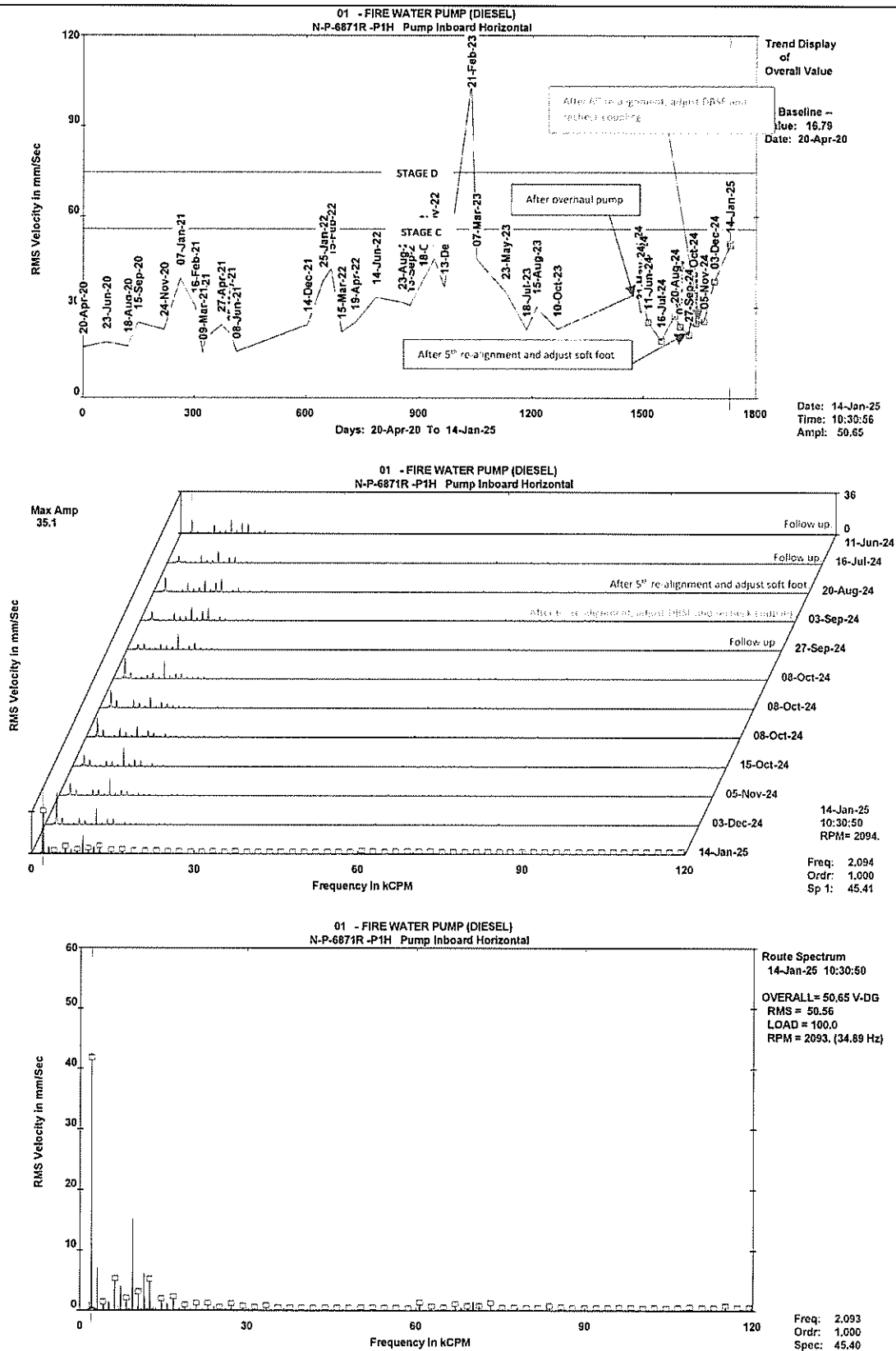


Fig 5. Trend/Waterfall/Spectrum Plot Point P1: Pump – Input shaft - DE – Horizontal – Velocity.

**Inspection Finding**

- **Engine:**
  1. The overall velocity of vibration at point E2 Engine DE in horizontal direction was slightly decrease from 10.52 to 10.19 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of engine speed and amplitude is in limit. Engine is in normal condition. (Fig 1)
  2. The overall acceleration of Peakvue mode at point E2 Engine DE in horizontal direction was slightly increase from 15.63 to 15.78 G's, Pk-Pk and enter to "Stage B (Fair)" severity by refer statistical alarm acceleration of Peakvue mode. The FFT spectrum shown dominant peak at 0.5x, 1x of engine speed and them harmonics which indicate to mechanical looseness problem.( Suspect to coupling and misalignment due to DBSE problem) (Fig 2)
- **Gearbox/Pump:**
  1. The overall velocity of vibration at point P3 pump output shaft DE in horizontal direction was more increase from 46.84 to 61.64 mm/s, RMS and enter to "Stage C (Alarm)" severity by refer statistical alarm. The FFT spectrum shown outstanding at 1x of pump input speed which indicate to misalignment problem. (Possible to coupling and DBSE abnormal.) (Fig 3)
  2. The overall acceleration of Peakvue mode at point P3 pump output shaft DE in horizontal direction was slightly increase from 1.10 to 1.38 G's, Pk-Pk. The FFT spectrum did not show bearing defect signal. (Fig 4)
  3. The overall velocity of vibration at point P1 pump input shaft DE in horizontal direction was increase from 38.60 to 50.65 mm/s, RMS. The FFT spectrum shown outstanding at 1x of pump input speed which indicate to misalignment problem. (Possible to coupling and DBSE abnormal.) (Fig 5)

**Conclusion**

- **Engine:** Normal condition.
- **Gearbox/Pump:** Pump had misalignment problem. (Possible to coupling and DBSE abnormal.)

**Recommendation**

- **Engine & Pump:**
  1. Should be consider stop P-6871R to standby mode and action as below step.
  2. Should be check coupling include rubber joint condition. If found damage should be replace new.
  3. Should be recheck DBSE. If found over limit by refer OEM should be adjusted.
  4. Should be re-alignment with high accuracy by refer OEM.
  5. Short-term, should be keep monitor trend of vibration and Peakvue mode in bi-weekly interval.

## Appendix A Overall vibration

Database: GC7\_(BTF).rbm  
Area: GC7  
Period Reported: 08-Oct-24 To 15-Jan-25

Equipment 1: FIRE WATER PUMP (DIESEL)

	DATE	TIME	OVERALL	
	----	----	-----	
N-P-6871R - E1H-Engine Outboard Horizontal			mm/Sec	
	08-Oct-24	15:31	10.54	--> After 6th re-alignment, adjust DBSE and recheck coupling.
	08-Oct-24	16:17	10.52	
	15-Oct-24	14:25	10.36	
	05-Nov-24	14:26	10.49	
	03-Dec-24	10:25	11.93	
	14-Jan-25	10:28	12.82	
N-P-6871R - E1F-Engine Outboard Horz Peakvue			G-s	
	08-Oct-24	15:31	12.25	
	08-Oct-24	16:17	12.00	
	15-Oct-24	14:25	15.60	
	05-Nov-24	14:26	13.90	
	03-Dec-24	10:25	20.30	
	14-Jan-25	10:28	17.27	
N-P-6871R - E1V-Engine Outboard Vertical			mm/Sec	
	08-Oct-24	15:31	8.932	
	08-Oct-24	16:17	7.440	
	15-Oct-24	14:25	7.367	
	05-Nov-24	14:27	7.633	
	03-Dec-24	10:25	8.635	
	14-Jan-25	10:28	8.294	
N-P-6871R - E1A-Engine Outboard Axial			mm/Sec	
	08-Oct-24	15:31	8.956	
	08-Oct-24	16:18	8.737	
	15-Oct-24	14:25	11.64	
	05-Nov-24	14:27	8.881	
	03-Dec-24	10:26	9.845	
	14-Jan-25	10:28	10.79	
N-P-6871R - E2H-Engine Inboard Horizontal			mm/Sec	
	08-Oct-24	15:32	16.41	
	08-Oct-24	16:18	13.73	
	15-Oct-24	14:26	14.29	
	05-Nov-24	14:27	13.85	
	03-Dec-24	10:26	10.52	
	14-Jan-25	10:29	10.19	
N-P-6871R - E2F-Engine Inboard Horz Peakvue			G-s	
	08-Oct-24	15:32	10.66	
	08-Oct-24	16:18	10.29	
	15-Oct-24	14:26	14.32	
	05-Nov-24	14:27	10.96	
	03-Dec-24	10:26	15.63	
	14-Jan-25	10:29	15.78	
N-P-6871R - E2V-Engine Inboard Vertical			mm/Sec	
	08-Oct-24	15:32	6.822	
	08-Oct-24	16:18	6.281	
	15-Oct-24	14:26	6.679	
	05-Nov-24	14:28	5.563	
	03-Dec-24	10:27	7.462	
	14-Jan-25	10:29	8.394	



## N-P-6871R - E2A-Engine Inboard Axial

		mm/Sec
08-Oct-24	15:32	9.685
08-Oct-24	16:18	8.611
15-Oct-24	14:26	9.419
05-Nov-24	14:28	8.883
03-Dec-24	10:27	10.01
14-Jan-25	10:29	11.12

## N-P-6871R - P1H-Pump Inboard Horizontal

		mm/Sec	
08-Oct-24	15:33	25.25	--> After 6th re-alignment, adjust DBSE and recheck coupling.
08-Oct-24	16:19	27.07	
15-Oct-24	14:26	24.77	
05-Nov-24	14:28	25.44	
03-Dec-24	10:21	38.60	
14-Jan-25	10:30	50.65	

## N-P-6871R - P1P-Pump Inboard Horz Peakvue

		G-s
08-Oct-24	15:33	5.686
08-Oct-24	16:19	3.397
15-Oct-24	14:26	3.770
05-Nov-24	14:28	2.303
03-Dec-24	10:21	1.509
14-Jan-25	10:30	2.086

## N-P-6871R - P1V-Pump Inboard Vertical

		mm/Sec
08-Oct-24	15:33	13.16
08-Oct-24	16:19	14.26
15-Oct-24	14:27	12.59
05-Nov-24	14:28	14.30
03-Dec-24	10:22	10.96
14-Jan-25	10:31	14.69

## N-P-6871R - P2H-Pump Outboard Horizontal

		mm/Sec
08-Oct-24	15:33	23.44
08-Oct-24	16:19	21.66
15-Oct-24	14:27	19.25
05-Nov-24	14:29	20.95
03-Dec-24	10:22	40.18
14-Jan-25	10:31	51.70

## N-P-6871R - P2P-Pump Outboard Horz Peakvue

		G-s
08-Oct-24	15:33	4.620
08-Oct-24	16:19	4.339
15-Oct-24	14:27	3.039
05-Nov-24	14:29	1.212
03-Dec-24	10:22	2.201
14-Jan-25	10:31	1.038

## N-P-6871R - P2V-Pump Outboard Vertical

		mm/Sec
08-Oct-24	15:33	12.05
08-Oct-24	16:19	11.13
15-Oct-24	14:27	12.09
05-Nov-24	14:29	12.00
03-Dec-24	10:23	12.87
14-Jan-25	10:32	12.95

## N-P-6871R - P2A-Pump Outboard Axial

		mm/Sec
08-Oct-24	15:34	19.84
08-Oct-24	16:20	19.20
15-Oct-24	14:28	17.65
05-Nov-24	14:29	19.40
03-Dec-24	10:23	20.15
14-Jan-25	10:32	20.86

## N-P-6871R - P3H-Pump Inboard Horizontal

		mm/Sec
08-Oct-24	15:34	23.77
08-Oct-24	16:20	22.93
15-Oct-24	14:28	19.53
05-Nov-24	14:30	19.98
03-Dec-24	10:23	<u>46.84</u>
14-Jan-25	10:32	61.64-->Follow up.

N-P-6871R - P3P-Pump Inboard Horz Peakvue			
			G-s
08-Oct-24	15:34	2.733	
08-Oct-24	16:20	2.531	
15-Oct-24	14:28	2.229	
05-Nov-24	14:30	2.606	
03-Dec-24	10:23	1.100	
14-Jan-25	10:33	1.384	
N-P-6871R - P3V-Pump Inboard Vertical			
			mm/Sec
08-Oct-24	15:34	22.16	
08-Oct-24	16:20	22.19	
15-Oct-24	14:28	20.66	
05-Nov-24	14:30	21.93	
03-Dec-24	10:24	22.92	
14-Jan-25	10:33	24.82	
N-P-6871R - P3A-Pump Inboard Axial			
			mm/Sec
08-Oct-24	15:34	10.58	
08-Oct-24	16:20	9.547	
15-Oct-24	14:29	10.37	
05-Nov-24	14:30	8.921	
03-Dec-24	10:24	12.86	
14-Jan-25	10:33	13.60	
N-P-6871R - P4H-Pump Outboard Horizontal			
			mm/Sec
08-Oct-24	15:34	12.19	
08-Oct-24	16:20	10.60	
15-Oct-24	14:29	10.12	
05-Nov-24	14:30	10.79	
03-Dec-24	10:24	22.81	
14-Jan-25	10:33	29.59	
N-P-6871R - P4P-Pump Outboard Horz Peakvue			
			G-s
08-Oct-24	15:35	2.407	
08-Oct-24	16:22	3.433	
15-Oct-24	14:29	3.108	
05-Nov-24	14:30	2.200	
03-Dec-24	10:24	2.484	
14-Jan-25	10:33	1.720	
N-P-6871R - P4V-Pump Outboard Vertical			
			mm/Sec
08-Oct-24	15:35	18.88	
08-Oct-24	16:22	18.70	
15-Oct-24	14:29	15.51	
05-Nov-24	14:31	16.50	
03-Dec-24	10:25	16.21	
14-Jan-25	10:34	18.31	
N-P-6871R - P4A-Pump Outboard Axial			
			mm/Sec
08-Oct-24	15:35	10.00	
08-Oct-24	16:22	11.17	
15-Oct-24	14:29	10.32	
05-Nov-24	14:31	8.907	
03-Dec-24	10:25	9.863	
14-Jan-25	10:34	13.52	
N-P-6871R - T1 -Temp engine NDE			
			C
08-Oct-24	15:35	96.00	
08-Oct-24	16:23	95.00	
15-Oct-24	14:30	80.00	
05-Nov-24	14:31	85.00	
03-Dec-24	10:28	63.00	
14-Jan-25	10:34	78.00	
N-P-6871R - T2 -Temp engine DE			
			C
08-Oct-24	15:35	95.00	
08-Oct-24	16:23	95.00	
15-Oct-24	14:30	83.00	
05-Nov-24	14:31	86.00	
03-Dec-24	10:29	67.00	
14-Jan-25	10:34	84.00	

## N-P-6871R - T3 -Temp pump DE

		C
08-Oct-24	15:35	68.00
08-Oct-24	16:23	66.00
15-Oct-24	14:30	41.00
05-Nov-24	14:31	43.00
03-Dec-24	10:29	34.00
14-Jan-25	10:34	44.00

## N-P-6871R - T4 -Temp pump NDE

		C
08-Oct-24	15:35	65.00
08-Oct-24	16:23	65.00
15-Oct-24	14:30	38.00
05-Nov-24	14:31	39.00
03-Dec-24	10:29	33.00
14-Jan-25	10:34	35.00

## N-P-6871R - T5 -Temp pump DE

		C
08-Oct-24	15:36	69.00
08-Oct-24	16:23	67.00
15-Oct-24	14:30	42.00
05-Nov-24	14:31	44.00
03-Dec-24	10:29	36.00
14-Jan-25	10:34	40.00

## N-P-6871R - T6 -Temp pump NDE

		C
08-Oct-24	15:36	55.00
08-Oct-24	16:23	57.00
15-Oct-24	14:30	35.00
05-Nov-24	14:31	34.00
03-Dec-24	10:29	31.00
14-Jan-25	10:34	28.00

## N-P-6871R - DP -Discharge pressure

		Bar
08-Oct-24	15:36	12.00
08-Oct-24	16:23	12.00
15-Oct-24	14:31	12.00
05-Nov-24	14:32	12.00
03-Dec-24	10:28	12.00
14-Jan-25	10:35	12.00

## N-P-6871R - SP -Speed

		Rpm
08-Oct-24	15:36	2074.0
08-Oct-24	16:23	2076.0
15-Oct-24	14:31	2084.0
05-Nov-24	14:32	2086.0
03-Dec-24	10:28	2091.0
14-Jan-25	10:35	2087.0

### Clarification Of Vibration Units:

Acc --> G-s P-P  
Vel --> mm/Sec RMS

## Appendix B

### Vibration Severity Listing

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

- **Stage A (Good)** Fault in low level:

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

- **Stage B (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.

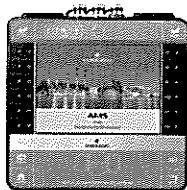
- **Stage C (Alarm)** Requires Attention at Next Opportunity:

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.

- **Stage D (Danger)** Requires Immediate Attention:

Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

### Appendix C: Data collection by CSI2140



Vibration Analyzer: CSI 2140 No.14

Serial No.: B21402218840

Calibration Date: 09-Aug-23

Calibration Due: 08-Aug-25

## **Appendix A: Severity of machine**

GC7_BTf Plant					Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-2025				Jan-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity				Summary of Severity
					Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	W01	W02	W03	W04	
3	N-B-6921-01C	INSTRUMENT AIR COMPRESSOR C	B	1M	Machine did not operate	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)				27-Jan-25	Stage B (FAIR)
21	N-P-6971A	FIRE WATER PUMP (DIESEL)	B	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)					Stage B (FAIR)
22	N-P-6971R	FIRE WATER PUMP (DIESEL)	B	1M	Stage C (ALARM)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage B (FAIR)		14-Jan-25			Stage C (ALARM)
23	N-P-6972	FIRE WATER PUMP	B	1M	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)		14-Jan-25			Stage A (GOOD)
26	N-P-6925-01A	FIRE FIGHTING WATER P. (MOTOR)	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)		14-Jan-25			Stage B (FAIR)
27	N-P-6925-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)		14-Jan-25			Stage B (FAIR)
28	N-P-6925-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)		14-Jan-25			Stage B (FAIR)
36	N-P-6925-07A	FIRE WATER PUMP A	S	1M	Stage B (FAIR)	Machine did not operate	Machine did not operate	Machine did not operate	Stage A (GOOD)		14-Jan-25			Stage A (GOOD)
38	N-G-6904	EMERGENCY GENERATOR 1100 KVA.	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Stage A (GOOD)	Machine did not operate		14-Jan-25			Stage A (GOOD)
52	N-P-6983-01A	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Jan-25	Stage A (GOOD)
53	N-P-6983-01B	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Jan-25	Stage A (GOOD)
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Jan-25	Stage A (GOOD)
63	N-P-6982R	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Jan-25	Stage A (GOOD)
Number of inspected machine					14	16	21	20	25					13

Stage A (GOOD)	Stage A : (Good): The vibration of newly commissioned machines would normally fall within this zone
Stage B (FAIR)	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
Stage C (ALARM)	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the machine should be inspected and repaired as soon as possible.
Machine did not operate	Machine did not operate; Machine is in standby mode.
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 testing program.

ประจำเดือน กุมภาพันธ์ 2568







# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**  
**Month of Survey and Data Collection: February 2025**

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

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 3, 11, 18 and 28 February 2025

Measurement plan 93 Equipment.

Checked 10 Equipment.

Machine did not operate 83 Equipment.

As show in Fig 1 And Table 1

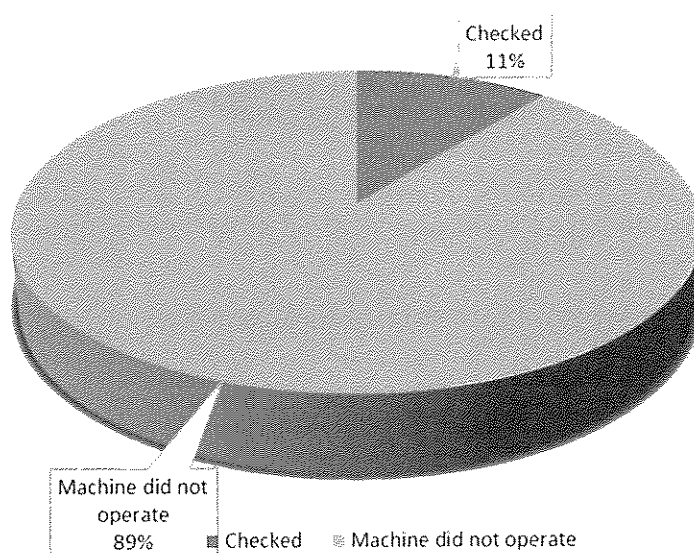
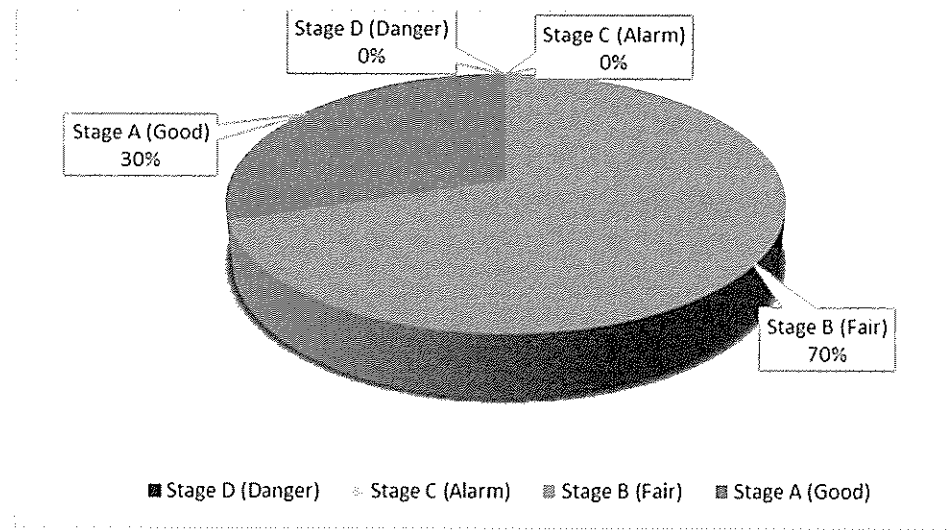


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	10	83	93
Percentage	100%	11%	89%	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	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	0	7	3	10
Percentage	0%	0%	70%	30%	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 10 - 1000 Hz, $r > 600$ rpm 2 - 1000 Hz, $r > 120$ rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
> 10.0	A	B	B	C	B	C	B	C
11.0 - 16.0	B	B	B	C	B	C	B	C
7.1 - 11.0	B	C	B	C	B	C	B	C
4.5 - 7.1	B	C	C	B	B	C	C	B
3.5 - 4.5	C	B	B	B	C	B	B	B
2.8 - 3.5	C	B	B	A	C	B	B	A
2.3 - 2.8	B	B	B	A	B	B	B	A
1.4 - 2.3	B	A	A	A	B	A	A	A
0.7 - 1.4	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

Newly Commissioned  
 Unrestricted long-term operation  
 Restricted long-term operation  
 Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	≤ 0.56	> 0.56 - 1.41	> 1.41 - 5.08	> 5.08
1000	≤ 1.13	> 1.13 - 2.82	> 2.82 - 9.87	> 9.87
1500	≤ 1.68	> 1.68 - 3.95	> 3.95 - 11.28	> 11.28
3000	≤ 3.95	> 3.95 - 8.46	> 8.46 - 28.2	> 28.2

#### 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: **Stage D (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: **Stage C (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: **Stage B (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	
>14 -28	>23 -45	>23 -45	>35 -71	>14 -28	>23 -45	>23 -45	>35 -71	

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: **Stage A (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	
≤ 14	≤ 23	≤ 23	≤ 35	≤ 14	≤ 23	≤ 23	≤ 35	

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 2025				
No.	Tag No.	Severity	Conclusion	Recommended
1	N-P-6871R	Stage B (Fair)	<u>Follow up.</u> <b>Engine:</b> Normal condition. <b>Gearbox/Pump:</b> Suspected that the discharge line has high pressure stuck in the system, causing induce high vibration.	<b>Engine &amp; Pump:</b> 1. <u>Short-term</u> , should be keep monitor trend of vibration and Peakvue mode in <u>bi-weekly interval</u> . 2. Should be plan to check pressure in discharge pipe line system. 3. Should be plan to check obstruction in discharge pipe line.

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.



## Vibration analysis report for GC7\_BTf Plant



Tag: N-P-6871R

Machine name: FIRE WATER PUMP

Inspected by: Natdanai T.

Severity: **Stage B (Fair)\*\*\***

Date of data measurement: 11 February 2025

Analyst by: Warut K.

Area: GC7\_BTf

**Main problem:** Follow up. Suspected that the discharge line has high pressure stuck in the system, causing induce high vibration.

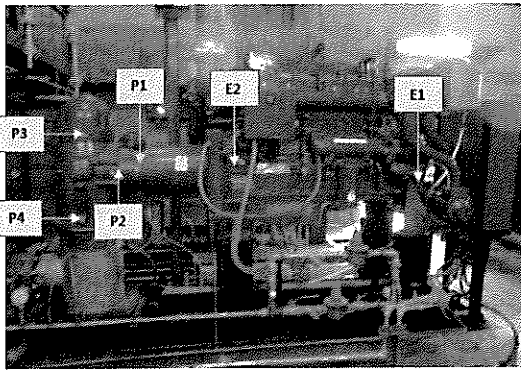
Review by: Warut K.

### Reference criteria

Standard		Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)	Unit
ISO-10816 part 6 (Engine)	Class V	≤14.1	>14.1 – 28.2	>28.2 – 44.6	>44.6	mm/S RMS
Statistical alarm Acceleration of Peakvue mode		≤10.5	>10.5 – 16.4	>16.4 – 18.5	>18.5	G's, Pk-PK
Statistical alarm velocity of pump		≤27.9	>27.9 – 55.9	>55.9 – 74.6	>74.6	mm/S RMS

**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.  
Statistical alarm was calculated from historical measurement more than 10 times.

### Machine description and vibration measurement point

	<b>Engine</b>
	Manufacturer: CATERPILLAR Type: DIESEL (CAT 3406C) Power: 217-359 kw Speed = 1,750-2,300 rpm DE Bearing: N/A NDE Bearing: N/A
	<b>Pump</b>
	Manufacturer: Bombas vertical gear pump Type: N/A Shaft input speed (P1, P2): 1,750-2,300 rpm DE Bearing: NDE Bearing: Shaft output speed (P3, P4): N/A DE Bearing: N/A NDE Bearing: N/A Tooth of Gear /High speed: N/A Tooth of Gear /Low speed: N/A GMF1 = N/A

# Vibration analysis

## Engine

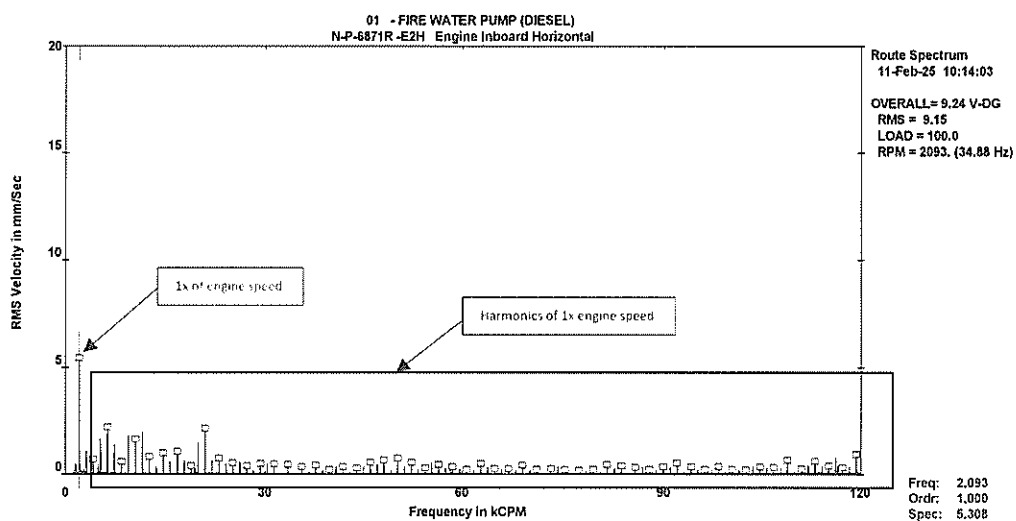
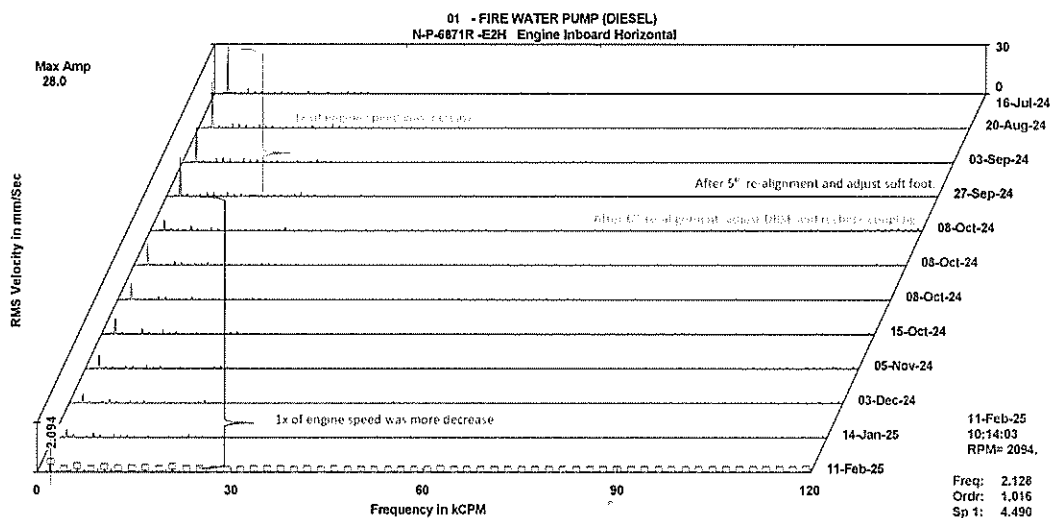
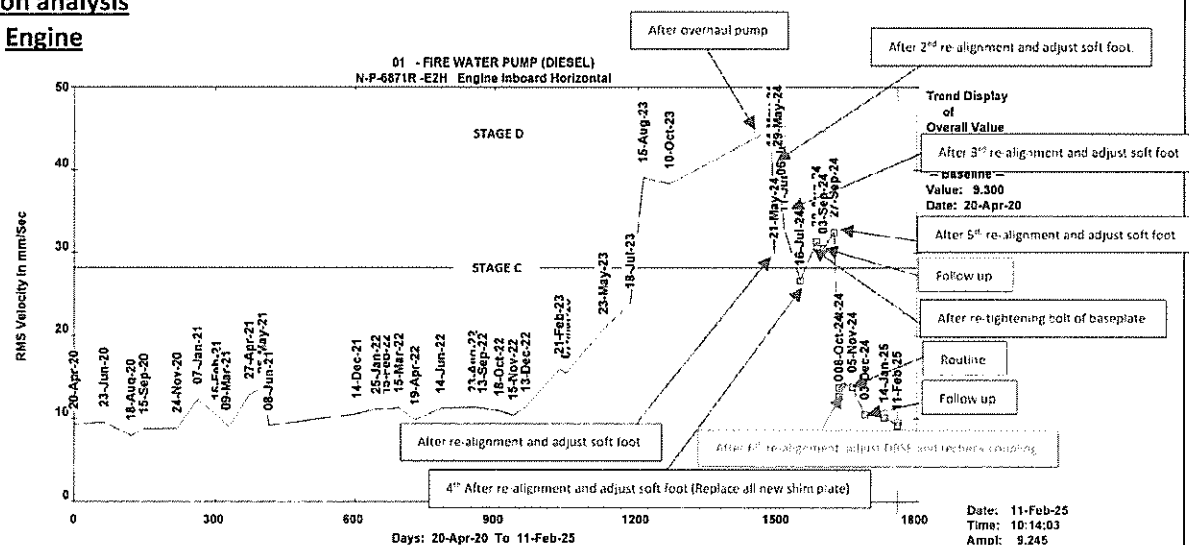
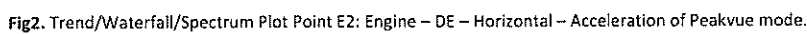


Fig1. Trend/Waterfall/Spectrum Plot Point E2: Engine – DE – Horizontal – Velocity.



• **Pump**

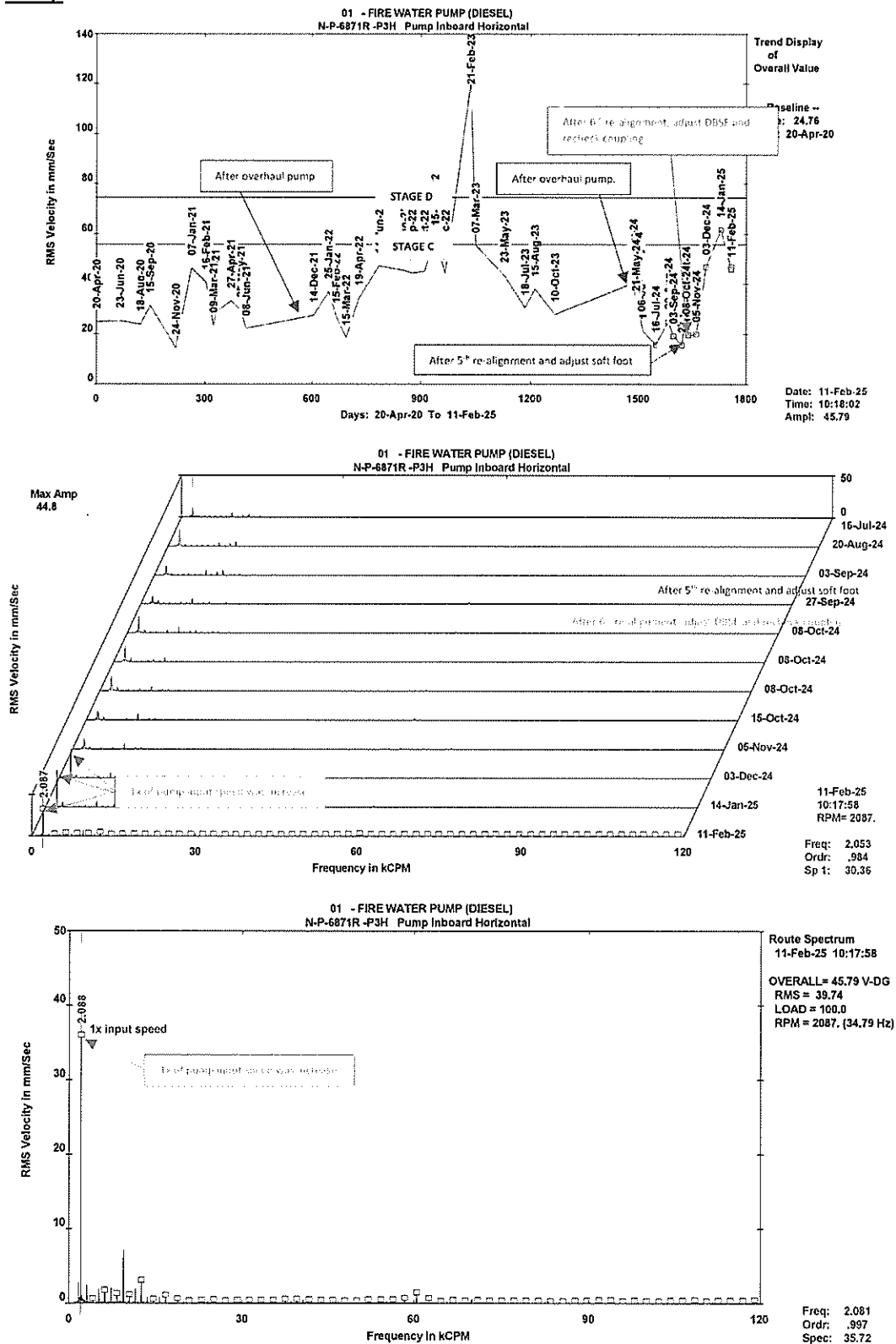


Fig 3. Trend/Waterfall/Spectrum Plot Point P3: Pump – Output shaft - DE – Horizontal – Velocity.

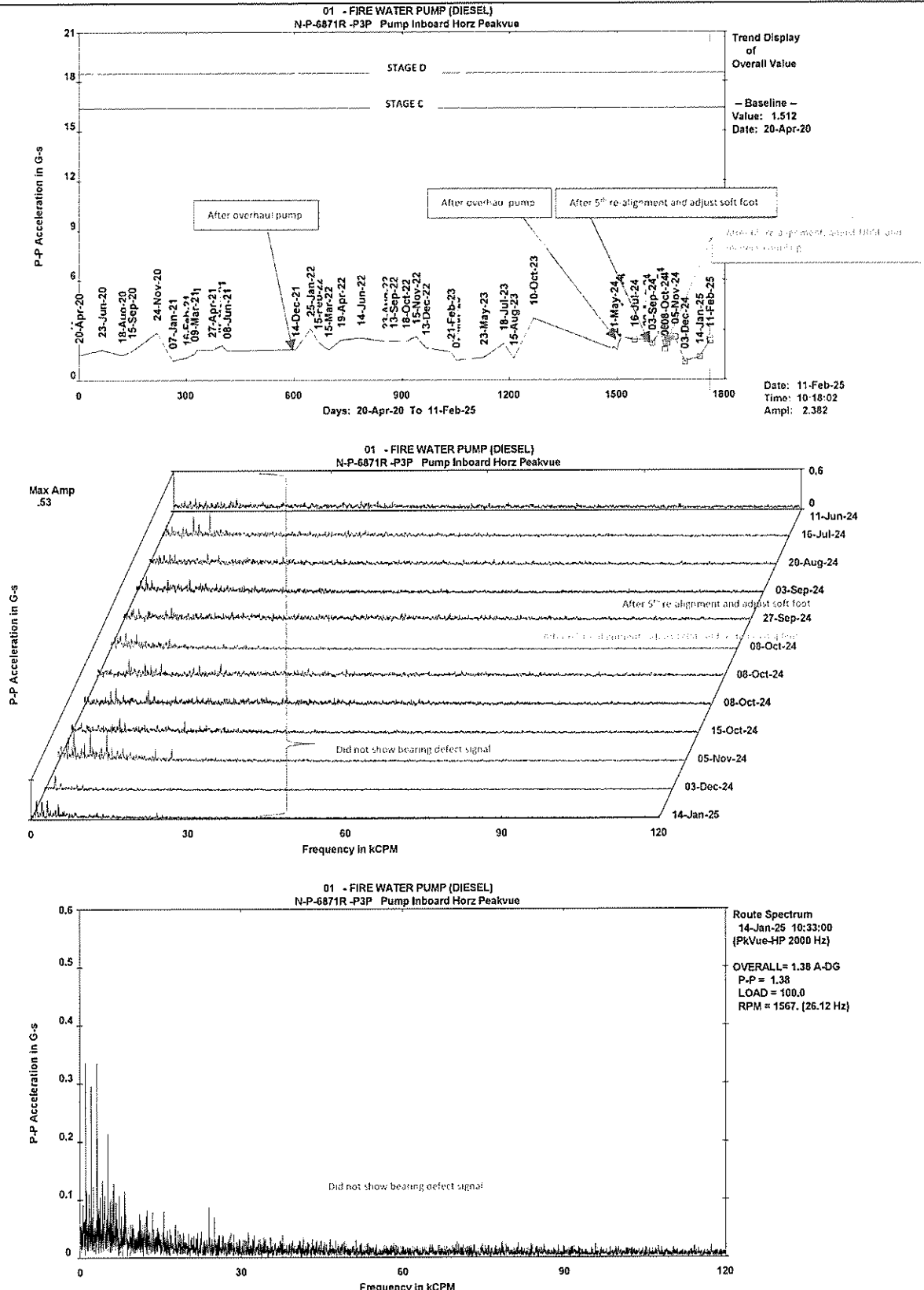


Fig 4. Trend/Waterfall/Spectrum Plot Point P3: Pump – Output shaft - DE – Horizontal – Acceleration of Peakvue mode.

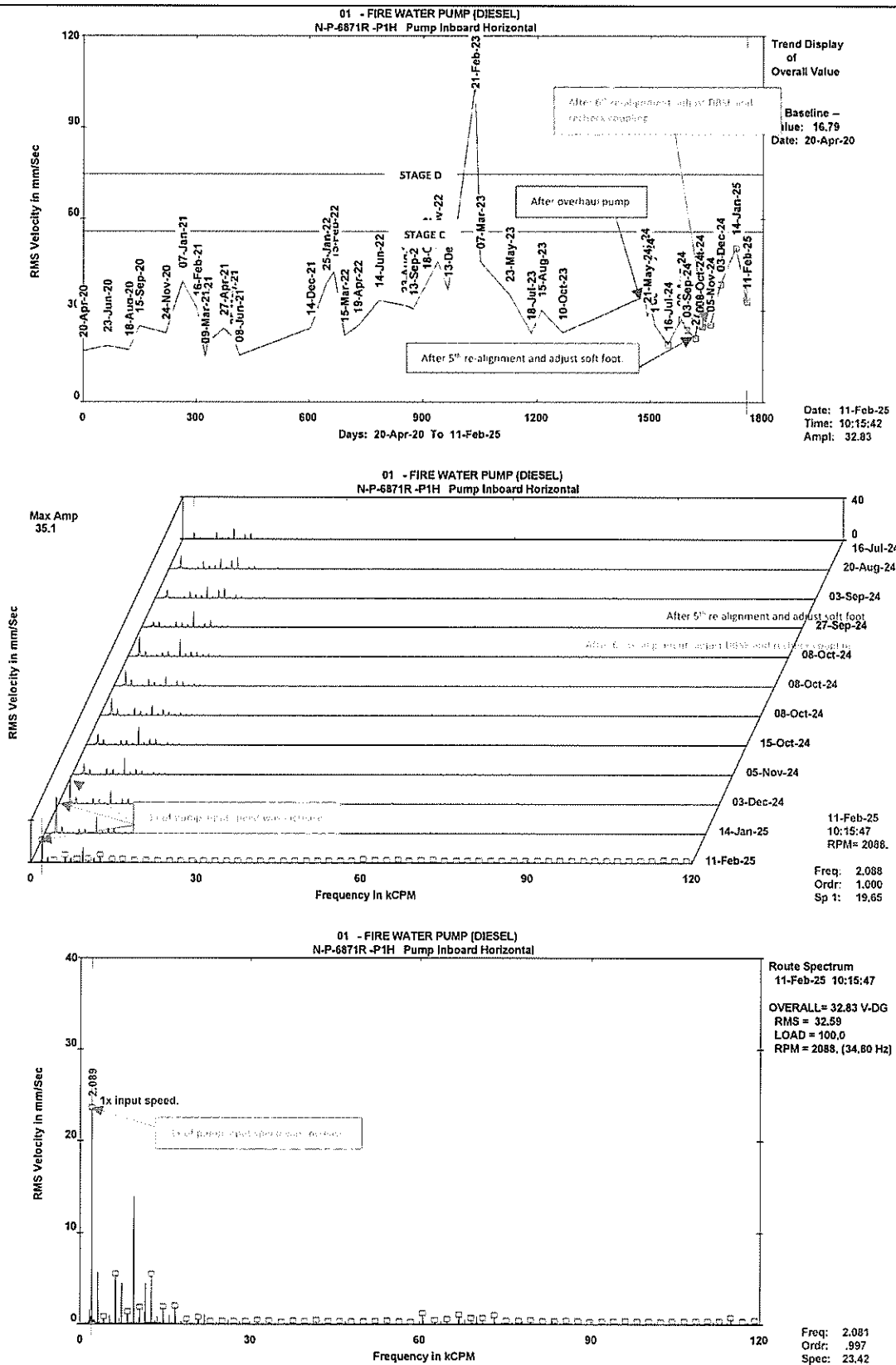


Fig 5. Trend/Waterfall/Spectrum Plot Point P1: Pump – Input shaft - DE – Horizontal – Velocity.

## Inspection Finding

- **Engine:**
  1. The overall velocity of vibration at point E2 Engine DE in horizontal direction was slightly decrease from 10.19 to 9.25 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of engine speed and amplitude is in limit. Engine is in normal condition. (Fig 1)
  2. The overall acceleration of Peakvue mode at point E2 Engine DE in horizontal direction was slightly decrease from 15.78 to 11.19 G's, Pk-Pk. The FFT spectrum shown dominant peak at 0.5x, 1x of engine speed and them harmonics and amplitude are in limit. It is characteristic of reciprocating engine. (Fig 2)
- **Gearbox/Pump:**
  1. The overall velocity of vibration at point P3 pump output shaft DE in horizontal direction was decrease from 61.64 to 45.79 mm/s, RMS and enter to "Stage B (Fair)" severity by refer statistical alarm. The FFT spectrum shown outstanding at 1x of pump input speed suspected the discharge line has high pressure stuck in the system, causing induce high vibration. (Fig 3)
  2. The overall acceleration of Peakvue mode at point P3 pump output shaft DE in horizontal direction was slightly increase from 1.38 to 2.38 G's, Pk-Pk. The FFT spectrum did not show bearing defect signal. (Fig 4)
  3. The overall velocity of vibration at point P1 pump input shaft DE in horizontal direction was increase from 50.65 to 32.83 mm/s, RMS. The FFT spectrum shown outstanding at 1x of pump input speed suspected the discharge line has high pressure stuck in the system, causing induce high vibration. (Fig 5)
  4. At site while machine stop (Before test vibration) found discharge pressure gauge in pipe line system about 15 Bar.
  5. At site while machine running (While test vibration) found discharge pressure gauge in pipe line system swing around 16-17.8 Bar.
  6. At site while machine stop (After test vibration) found discharge pressure gauge in pipe line system can read about 17.8 Bar. (Did not come back to 0 Bar)
  7. Usually normal operating condition discharge pressure gauge in pipe line system (While machine running) is in about 11-12 Bar.

## Conclusion

- **Engine:** Normal condition.
- **Gearbox/Pump:** Suspected that the discharge line has high pressure stuck in the system, causing induce high vibration.

## Recommendation

- **Engine & Pump:**
  1. Short-term, should be keep monitor trend of vibration and Peakvue mode in bi-weekly interval.
  2. Should be plan to check pressure in discharge pipe line system.
  3. Should be plan to check obstruction in discharge pipe line.



## Appendix A Overall vibration

Database: GC7\_(BTF).xbm  
Area: GC7  
Period Reported: 15-Oct-24 To 14-Feb-25

Equipment 1: FIRE WATER PUMP (DIESEL)

	DATE	TIME	OVERALL
	----	----	-----
N-P-6871R - E1H-Engine Outboard Horizontal			mm/Sec
	15-Oct-24	14:25	10.36
	05-Nov-24	14:26	10.49
	03-Dec-24	10:25	11.93
	14-Jan-25	10:28	12.82
	11-Feb-25	10:13	11.71
N-P-6871R - E1P-Engine Outboard Horz Peakvue			G-s
	15-Oct-24	14:25	15.60
	05-Nov-24	14:26	13.90
	03-Dec-24	10:25	20.30
	14-Jan-25	10:28	17.27
	11-Feb-25	10:13	13.36
N-P-6871R - E1V-Engine Outboard Vertical			mm/Sec
	15-Oct-24	14:25	7.367
	05-Nov-24	14:27	7.633
	03-Dec-24	10:25	8.635
	14-Jan-25	10:28	8.294
	11-Feb-25	10:13	7.707
N-P-6871R - E1A-Engine Outboard Axial			mm/Sec
	15-Oct-24	14:25	11.64
	05-Nov-24	14:27	8.881
	03-Dec-24	10:26	9.845
	14-Jan-25	10:28	10.79
	11-Feb-25	10:13	8.974
N-P-6871R - E2H-Engine Inboard Horizontal			mm/Sec
	15-Oct-24	14:26	14.29
	05-Nov-24	14:27	13.85
	03-Dec-24	10:26	10.52
	14-Jan-25	10:29	10.19
	11-Feb-25	10:14	9.245
N-P-6871R - E2P-Engine Inboard Horz Peakvue			G-s
	15-Oct-24	14:26	14.32
	05-Nov-24	14:27	10.96
	03-Dec-24	10:26	15.63
	14-Jan-25	10:29	15.78
	11-Feb-25	10:14	11.19
N-P-6871R - E2V-Engine Inboard Vertical			mm/Sec
	15-Oct-24	14:26	6.679
	05-Nov-24	14:28	5.563
	03-Dec-24	10:27	7.462
	14-Jan-25	10:29	8.394
	11-Feb-25	10:14	5.658
N-P-6871R - E2A-Engine Inboard Axial			mm/Sec
	15-Oct-24	14:26	9.419
	05-Nov-24	14:28	8.883
	03-Dec-24	10:27	10.01
	14-Jan-25	10:29	11.12



## Vibration analysis report for GC7\_BTF Plant



	11-Feb-25	10:14	9.758
N-P-6871R - P1H-Pump Inboard Horizontal			
			mm/Sec
	15-Oct-24	14:26	24.77
	05-Nov-24	14:28	25.44
	03-Dec-24	10:21	38.60
	14-Jan-25	10:30	50.65
	11-Feb-25	10:15	32.83
N-P-6871R - P1P-Pump Inboard Horz Peakvue			
			G-s
	15-Oct-24	14:26	3.770
	05-Nov-24	14:28	2.303
	03-Dec-24	10:21	1.509
	14-Jan-25	10:30	2.086
	11-Feb-25	10:15	3.749
N-P-6871R - P1V-Pump Inboard Vertical			
			mm/Sec
	15-Oct-24	14:27	12.59
	05-Nov-24	14:28	14.30
	03-Dec-24	10:22	10.96
	14-Jan-25	10:31	14.69
	11-Feb-25	10:16	16.94
N-P-6871R - P2H-Pump Outboard Horizontal			
			mm/Sec
	15-Oct-24	14:27	19.25
	05-Nov-24	14:29	20.95
	03-Dec-24	10:22	40.18
	14-Jan-25	10:31	51.70
	11-Feb-25	10:16	33.07
N-P-6871R - P2P-Pump Outboard Horz Peakvue			
			G-s
	15-Oct-24	14:27	3.039
	05-Nov-24	14:29	1.212
	03-Dec-24	10:22	2.201
	14-Jan-25	10:31	1.038
	11-Feb-25	10:16	1.697
N-P-6871R - P2V-Pump Outboard Vertical			
			mm/Sec
	15-Oct-24	14:27	12.09
	05-Nov-24	14:29	12.00
	03-Dec-24	10:23	12.87
	14-Jan-25	10:32	12.95
	11-Feb-25	10:17	19.63
N-P-6871R - P2A-Pump Outboard Axial			
			mm/Sec
	15-Oct-24	14:28	17.65
	05-Nov-24	14:29	19.40
	03-Dec-24	10:23	20.15
	14-Jan-25	10:32	20.86
	11-Feb-25	10:17	19.49
N-P-6871R - P3H-Pump Inboard Horizontal			
			mm/Sec
	15-Oct-24	14:28	19.53
	05-Nov-24	14:30	19.98
	03-Dec-24	10:23	46.84
	14-Jan-25	10:32	61.64
	11-Feb-25	10:17	45.79
N-P-6871R - P3P-Pump Inboard Horz Peakvue			
			G-s
	15-Oct-24	14:28	2.229
	05-Nov-24	14:30	2.606
	03-Dec-24	10:23	1.100
	14-Jan-25	10:33	1.384
	11-Feb-25	10:18	2.382
N-P-6871R - P3V-Pump Inboard Vertical			
			mm/Sec
	15-Oct-24	14:28	20.66
	05-Nov-24	14:30	21.93
	03-Dec-24	10:24	22.92
	14-Jan-25	10:33	24.82

	11-Feb-25	10:18	22.55
N-P-6871R - P3A-Pump Inboard Axial			
			mm/Sec
	15-Oct-24	14:29	10.37
	05-Nov-24	14:30	8.921
	03-Dec-24	10:24	12.86
	14-Jan-25	10:33	13.60
	11-Feb-25	10:18	12.46
N-P-6871R - P4H-Pump Outboard Horizontal			
			mm/Sec
	15-Oct-24	14:29	10.12
	05-Nov-24	14:30	10.79
	03-Dec-24	10:24	22.81
	14-Jan-25	10:33	29.59
	11-Feb-25	10:19	21.23
N-P-6871R - P4P-Pump Outboard Horz Peakvue			
			G-s
	15-Oct-24	14:29	3.108
	05-Nov-24	14:30	2.200
	03-Dec-24	10:24	2.484
	14-Jan-25	10:33	1.720
	11-Feb-25	10:19	3.047
N-P-6871R - P4V-Pump Outboard Vertical			
			mm/Sec
	15-Oct-24	14:29	15.51
	05-Nov-24	14:31	16.50
	03-Dec-24	10:25	16.21
	14-Jan-25	10:34	18.31
	11-Feb-25	10:19	20.56
N-P-6871R - P4A-Pump Outboard Axial			
			mm/Sec
	15-Oct-24	14:29	10.32
	05-Nov-24	14:31	8.907
	03-Dec-24	10:25	9.863
	14-Jan-25	10:34	13.52
	11-Feb-25	10:19	13.86
N-P-6871R - T1 -Temp engine NDE			
			C
	15-Oct-24	14:30	80.00
	05-Nov-24	14:31	85.00
	03-Dec-24	10:28	63.00
	14-Jan-25	10:34	78.00
	11-Feb-25	10:20	91.00
N-P-6871R - T2 -Temp engine DE			
			C
	15-Oct-24	14:30	83.00
	05-Nov-24	14:31	86.00
	03-Dec-24	10:29	67.00
	14-Jan-25	10:34	84.00
	11-Feb-25	10:20	88.00
N-P-6871R - T3 -Temp pump DE			
			C
	15-Oct-24	14:30	41.00
	05-Nov-24	14:31	43.00
	03-Dec-24	10:29	34.00
	14-Jan-25	10:34	44.00
	11-Feb-25	10:20	43.00
N-P-6871R - T4 -Temp pump NDE			
			C
	15-Oct-24	14:30	38.00
	05-Nov-24	14:31	39.00
	03-Dec-24	10:29	33.00
	14-Jan-25	10:34	35.00
	11-Feb-25	10:20	44.00
N-P-6871R - T5 -Temp pump DE			
			C
	15-Oct-24	14:30	42.00
	05-Nov-24	14:31	44.00
	03-Dec-24	10:29	36.00
	14-Jan-25	10:34	40.00

	11-Feb-25	10:20	50.00
N-P-6871R - T6 -Temp pump NDE			
			C
	15-Oct-24	14:30	35.00
	05-Nov-24	14:31	34.00
	03-Dec-24	10:29	31.00
	14-Jan-25	10:34	28.00
	11-Feb-25	10:20	35.00
N-P-6871R - DP1-Dischage pressure			
			Bar
	15-Oct-24	14:31	12.00
	05-Nov-24	14:32	12.00
	03-Dec-24	10:28	12.00
	14-Jan-25	10:35	12.00
	11-Feb-25	10:20	12.00
N-P-6871R - DP2-Dischage pressure (Pipe line)			
			Bar
	11-Feb-25	10:21	16.50
N-P-6871R - SP -Speed			
			Rpm
	15-Oct-24	14:31	2084.0
	05-Nov-24	14:32	2086.0
	03-Dec-24	10:28	2091.0
	14-Jan-25	10:35	2087.0

-----

Clarification Of Vibration Units:

Acc --> G-s P-P  
Vel --> mm/Sec RMS

## Appendix B

### Vibration Severity Listing

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

- **Stage A (Good)** Fault in low level:

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

- **Stage B (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.

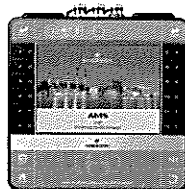
- **Stage C (Alarm)** Requires Attention at Next Opportunity:

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.

- **Stage D (Danger)** Requires Immediate Attention:

Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

## Appendix C: Data collection by CSI2140



Vibration Analyzer: CSI 2140 No.14

Serial No.: B21402218840

Calibration Date: 09-Aug-23

Calibration Due: 08-Aug-25

## **Appendix A: Severity of machine**

GC7_BTf Plant					Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-2025				Feb-25	
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity		Summary of Severity		Summary of Severity		Summary of Severity				
					Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity			
1	N-B-6921-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Summary of Severity	
22	N-P-6871R	FIRE WATER PUMP (DIESEL)	B	1M	Stage C (ALARM)	Stage A (GOOD)	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)			11-Feb-25			Stage B (FAIR)
23	N-P-6872	FIRE WATER PUMP	B	1M	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)			11-Feb-25	18-Feb-25		Stage A (GOOD)
26	N-P-6925-01A	FIRE FIGHTING WATER P. (MOTOR)	5	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)				18-Feb-25		Stage B (FAIR)
27	N-P-6925-01B	FIRE WATER PUMP DIESEL ENGINE B	5	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)				18-Feb-25		Stage B (FAIR)
28	N-P-6925-01R	FIRE WATER PUMP DIESEL ENGINE R	5	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)				18-Feb-25	Stage B (FAIR)	
34	N-P-6949A	METHANOL PUMP	B	1M	Machine did not operate	Machine did not operate	Stage A (GOOD)	Machine did not operate	Machine did not operate					Stage B (FAIR)	
52	N-P-6983-01A	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				28-Feb-25	Stage B (FAIR)	
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate			11-Feb-25		Stage A (GOOD)	
62	N-P-6982A	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate			11-Feb-25		Stage A (GOOD)	
Number of inspected machine					15	22	20	25	13					Stage B (FAIR)	10

Stage A (GOOD)	Stage A : (Good): The vibration of newly commissioned machines would normally fall within this zone
Stage B (FAIR)	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
Stage C (ALARM)	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the
Machine did not operate	Machine did not operate. Machine is in standby mode.
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 มีนาคม 2568







# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**

**Month of Survey and Data Collection: March 2025**

Inspected by: CHAIWAT PAEWPOLSONG

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 04 and 18 March 2025

Measurement plan 93 Equipment.

Checked 8 Equipment.

Machine did not operate 85 Equipment.

As show in Fig 1 And Table 1

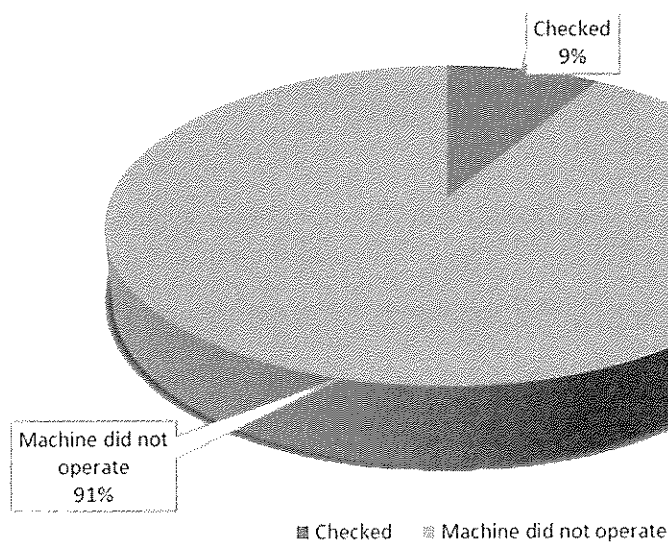
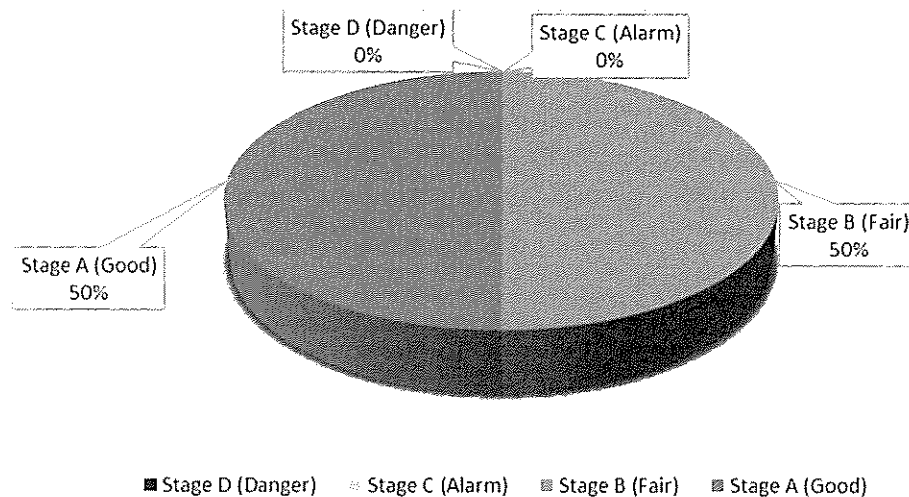


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	8	85	93
Percentage	100%	9%	91%	100%

During this period, GCME has collected a vibration data are 8 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	0	4	4	8
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 inside

Velocity 10 - 1000 Hz, $r > 600$ rpm 1 - 1000 Hz, $r > 120$ rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
Limit, mm/s, rms								
> 18.8	D	D	D	D	D	D	D	D
11.0 - 18.8	D	D	D	D	D	D	D	D
7.1 - 11.0	D	D	D	C	D	D	D	C
4.5 - 7.1	D	C	C	D	D	C	C	D
3.5 - 4.5	C	D	D	D	C	D	D	D
2.8 - 3.5	C	D	D	A	C	D	D	A
2.3 - 2.8	D	D	D	A	D	D	D	A
1.4 - 2.3	D	A	A	A	D	A	A	A
0.7 - 1.4	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

 Newly Commissioned  
 Unrestricted long-term operation  
 Restricted long-term operation  
 Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	$\leq 0.56$	$> 0.56 - 1.41$	$> 1.41 - 5.08$	$> 5.08$
1000	$\leq 1.13$	$> 1.13 - 2.82$	$> 2.82 - 9.87$	$> 9.87$
1500	$\leq 1.68$	$> 1.68 - 3.95$	$> 3.95 - 11.28$	$> 11.28$
3000	$\leq 3.95$	$> 3.95 - 8.46$	$> 8.46 - 28.2$	$> 28.2$

#### 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: **Stage D (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: **Stage C (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: **Stage B (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: **Stage A (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 2025				
No.	Tag No.	Severity	Conclusion	Recommended
-	-	-	-	-

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.



## **Appendix A: Severity of machine**

GC7_BTf Plant					Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-2025				Mar-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity				Summary of Severity
					Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	W09	W10	W11	W12	
1	N-P-692J-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Stage B (FAIR)			13-Mar-25		Stage B (FAIR)
22	N-P-6871R	FIRE WATER PUMP (DIESEL)	B	1M	Stage A (GOOD)	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage A (GOOD)			18-Mar-25		Stage A (GOOD)
23	N-P-6872	FIRE WATER PUMP	B	1M	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)			18-Mar-25		Stage A (GOOD)
26	N-P-692S-01A	FIRE FIGHTING WATER P. (MOTOR)	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)					Stage B (FAIR)
27	N-P-692S-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	4-Mar-25				Stage B (FAIR)
28	N-P-692S-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	4-Mar-25				Stage B (FAIR)
36	N-P-692S-07A	FIRE WATER PUMP A	S	1M	Machine did not operate	Machine did not operate	Stage A (GOOD)	Stage A (GOOD)	Machine did not operate	4-Mar-25				Stage A (GOOD)
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Stage A (GOOD)	Stage A (GOOD)	6-Mar-25				Stage A (GOOD)
Number of inspected machine					22	20	25	13	10					8

Stage A (GOOD)	Stage A : Good: The vibration of newly commissioned machines would normally fall within this zone
Stage B (FAIR)	Stage B : Allowable: Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
Stage C (ALARM)	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the
Machine did not operate	Machine did not operate: Machine is in standby mode.
Out of service	Out of service : Cannot measure due to machine do not run as a result of machine overhaul to repair in accessible, 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 rotating process.



# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**

**Month of Survey and Data Collection: April 2025**

Inspected by: CHAIWAT PAEWPOLSONG

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 01, 22 and 25 April 2025

Measurement plan 93 Equipment.

Checked 12 Equipment.

Machine did not operate 81 Equipment.

As show in Fig 1 And Table 1

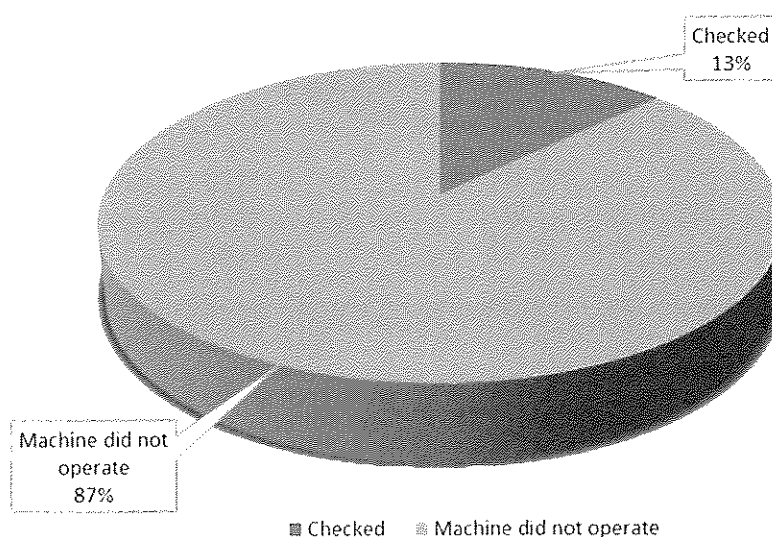
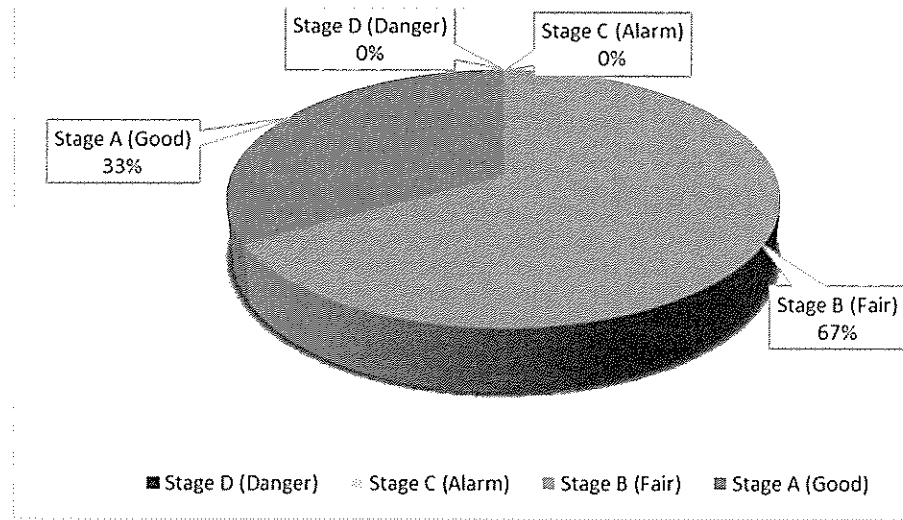


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	12	81	93
Percentage	100%	13%	87%	100%

During this period, GCME has collected a vibration data are 12 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	0	8	4	12
Percentage	0%	0%	67%	33%	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 10 - 1000 Hz, $r > 600$ rpm 2 - 1000 Hz, $r > 120$ rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
Limit, mm/s, rms								
> 18.0	D	D	D	D	D	D	D	D
11.0 - 18.0	D	D	D	D	D	D	D	D
7.1 - 11.0	D	D	D	C	D	D	D	C
4.5 - 7.1	D	C	C	B	D	C	C	B
3.5 - 4.5	C	B	B	B	C	B	B	B
2.8 - 3.5	C	B	B	A	C	B	B	A
2.5 - 2.8	B	B	B	A	B	B	B	A
1.4 - 2.5	B	A	A	A	A	A	A	A
0.7 - 1.4	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

 Newly Commissioned  
 Unrestricted long-term operation  
 Restricted long-term operation  
 Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	$\leq 0.56$	$> 0.56 - 1.41$	$> 1.41 - 5.08$	$> 5.08$
1000	$\leq 1.13$	$> 1.13 - 2.82$	$> 2.82 - 9.87$	$> 9.87$
1500	$\leq 1.68$	$> 1.68 - 3.95$	$> 3.95 - 11.28$	$> 11.28$
3000	$\leq 3.95$	$> 3.95 - 8.46$	$> 8.46 - 28.2$	$> 28.2$

#### 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: **Stage D (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: **Stage C (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: **Stage B (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: **Stage A (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	
≤ 14	≤ 23	≤ 23	≤ 35	≤ 14	≤ 23	≤ 23	≤ 35	

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"

April 2025				
No.	Tag No.	Severity	Conclusion	Recommended
-	-	-	-	-

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.

## **Appendix A: Severity of machine**

GC7_BTf Plant					Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-2025					Apr-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	W13	W14	W15	W16	W17	Summary of Severity
1	N-P-6921-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Stage B (FAIR)	Stage B (FAIR)	1-Apr-25					Stage B (FAIR)
2	N-P-6921-01B	INSTRUMENT AIR COMPRESSOR B	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Apr-25		Stage B (FAIR)
22	N-P-6921R	FIRE WATER PUMP (DIESEL)	B	1M	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage A (GOOD)	Stage A (GOOD)				25-Apr-25		Stage A (GOOD)
26	N-P-6925-01A	FIRE FIGHTING WATER P. (MOTOR)	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	1-Apr-25					Stage B (FAIR)
27	N-P-6925-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	1-Apr-25					Stage B (FAIR)
28	N-P-6925-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	1-Apr-25					Stage B (FAIR)
29	N-P-6925-02A	FIRE FIGHTING JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate						Stage B (FAIR)
30	N-P-6925-02R	FIRE FIGHTING JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	1-Apr-25					Stage B (FAIR)
36	N-P-6925-07A	FIRE WATER PUMP A	S	1M	Machine did not operate	Machine did not operate	Stage A (GOOD)	Machine did not operate	Stage A (GOOD)	1-Apr-25					Stage A (GOOD)
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	1-Apr-25					Stage A (GOOD)
62	N-P-6982A	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate				27-Apr-25		Stage A (GOOD)
65	N-P-6981R	BUTENE-1/LPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	1-Apr-25					Stage B (FAIR)
Number of Inspected machine					20	25	13	10	8						12

Stage A (GOOD)	Stage A : (Good) The location of newly commissioned machines would normally fall within this zone
Stage B (FAIR)	Stage B : (Allowable) Machines with vibration within this zone are normally considered acceptable for unscheduled long term operation.
Stage C (ALARM)	Stage C : (Just tolerable) Machines with vibration within this zone are normally considered unsatisfactory for long term continuous operation. Generally, the
Machine did not operate	Machine did not operate. Machine is in standby mode.
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.

**ประจำเดือนเมษายน 2568**





# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**

**Month of Survey and Data Collection: April 2025**

Inspected by: CHAIWAT PAEWPOLSONG

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

## Condition Monitoring Service Integrity and Reliability Department

**GCME** GC Maintenance and Engineering Company Limited

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





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6. Vibration Analysis Report .....	8
7. Appendix A: Severity of machine .....	9

## Vibration condition monitoring

### 1. Executive Summary

Measurement Start-Finish: 01, 22 and 25 April 2025

Measurement plan 93 Equipment.

Checked 12 Equipment.

Machine did not operate 81 Equipment.

As show in Fig 1 And Table 1

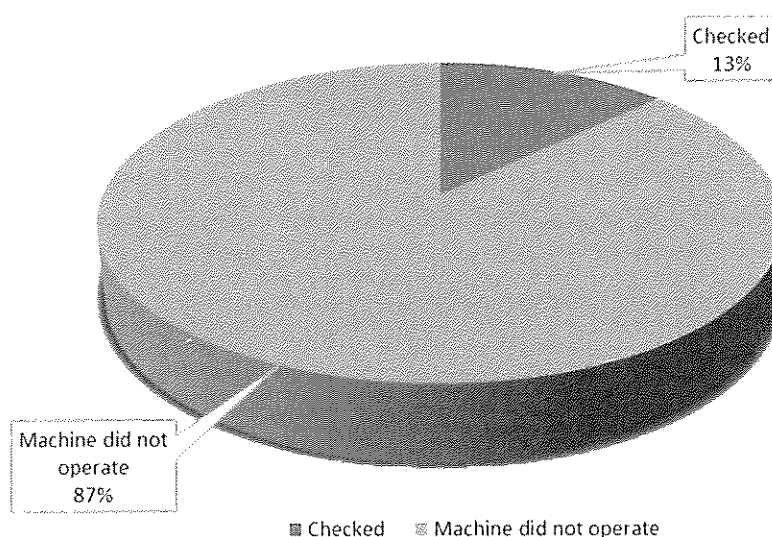


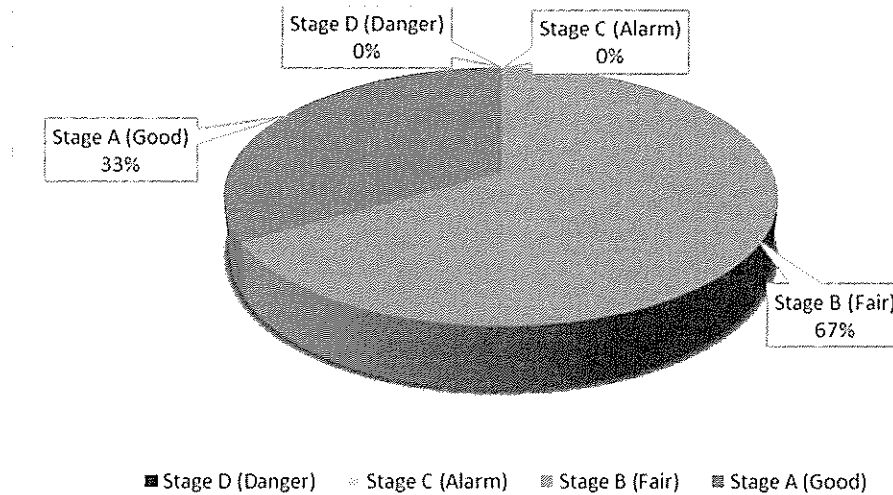
Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	12	81	93
Percentage	100%	13%	87%	100%



During this period, GCME has collected a vibration data are 12 Equipment. The result can be categorized into each severity kindly see attachment more detailed as following list.



Severity	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	0	8	4	12
Percentage	0%	0%	67%	33%	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 10 - 1000 Hz, r > 600 mm 1 - 1000 Hz, r > 120 mm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
> 10.0	A	B	B	A	A	B	A	B
11.0 - 10.0	A	B	B	A	A	B	A	B
7.1 - 11.0	A	B	B	C	A	B	A	C
4.5 - 7.1	A	C	C	B	A	C	C	B
3.5 - 4.5	C	B	B	B	C	B	B	B
2.8 - 3.5	C	B	B	A	C	B	B	B
2.5 - 2.8	B	B	B	A	B	B	B	A
1.6 - 2.5	B	A	A	A	B	A	A	B
0.7 - 1.6	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

	Newly Commissioned
	Unrestricted long-term operation
	Restricted long-term operation
	Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	≤ 0.56	> 0.56 - 1.41	> 1.41 - 5.08	> 5.08
1000	≤ 1.13	> 1.13 - 2.82	> 2.82 - 9.87	> 9.87
1500	≤ 1.68	> 1.68 - 3.95	> 3.95 - 11.28	> 11.28
3000	≤ 3.95	> 3.95 - 8.46	> 8.46 - 28.2	> 28.2

#### 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: **Stage D (DANGER)** Requires Immediate Attention.

A level of vibration severity at which the probability of a severe 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: **Stage C (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: **Stage B (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: **Stage A (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	
≤ 14	≤ 23	≤ 23	≤ 35	≤ 14	≤ 23	≤ 23	≤ 35	

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"

April 2025				
No.	Tag No.	Severity	Conclusion	Recommended
-	-	-	-	-

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.

## **Appendix A: Severity of machine**

GC7_BTf Plant					Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-2025				Apr-25		
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity		Summary of Severity		Summary of Severity		Summary of Severity		Summary of Severity			
					Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate
1	N-B-6921-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
2	N-B-6921-01B	INSTRUMENT AIR COMPRESSOR B	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
22	N-P-6871R	FIRE WATER PUMP (DIESEL)	B	1M	Stage A (GOOD)	Stage B (FAIR)	Stage B (FAIR)	Stage C (ALARM)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	
26	N-P-6925-01A	FIRE FIGHTING WATER P. (MOTOR)	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	
27	N-P-6925-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	
28	N-P-6925-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	
29	N-P-6925-02A	FIRE FIGHTING JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
30	N-P-6925-02R	FIRE FIGHTING JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
36	N-P-6925-07A	FIRE WATER PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
62	N-P-6982A	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
65	N-P-6981R	BUTENE-1/LPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	
Number of Inspected machine					20	25	13	10	8							12

Stage A (GOOD)	Stage A : (Good) The vibration of newly commissioned machines would normally fall within this zone
Stage B (FAIR)	Stage B : (Allowable) Machines with vibration within this zone are normally considered acceptable for unrestricted long term operation.
Stage C (ALARM)	Stage C : (Just tolerable) Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the
Machine did not operate	Machine did not operate: Machine is in standby mode.
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.
Correct 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.

ประจำเดือนพฤษภาคม 2568







# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**  
**Month of Survey and Data Collection: May 2025**

Inspected by: CHAIWAT PAEWPOLSONG

Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 06 and 20 May 2025

Measurement plan 93 Equipment.

Checked 13 Equipment.

Machine did not operate 80 Equipment.

As show in Fig 1 And Table 1

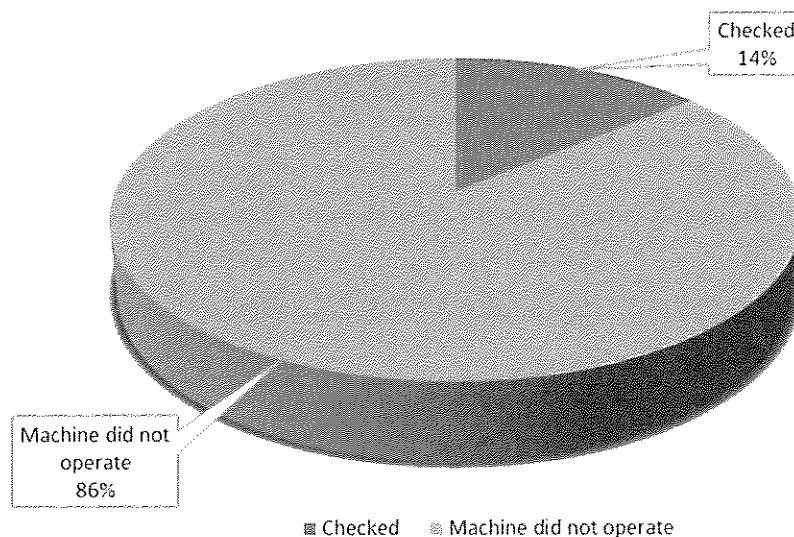
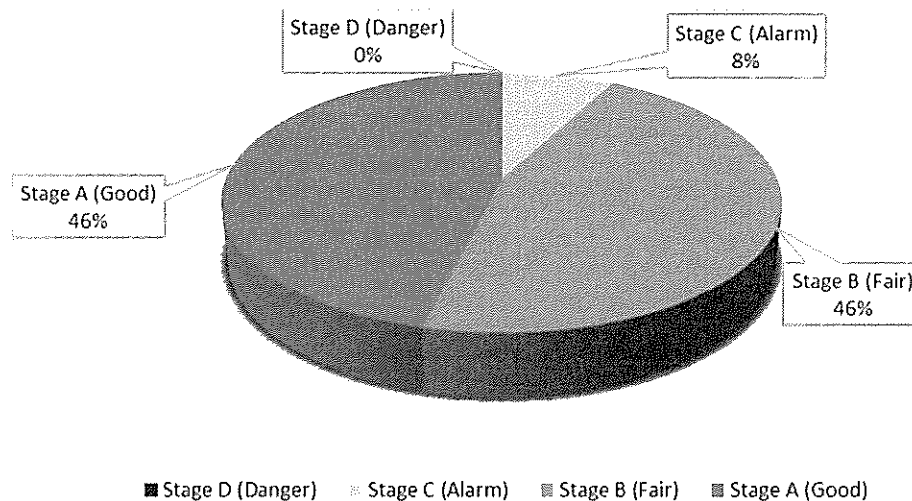


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	13	80	93
Percentage	100%	14%	86%	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	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	1	6	6	13
Percentage	0%	8%	46%	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.

### 3. Reference Standard

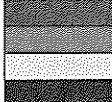
In order to clearly certify a vibration severity of any equipment, an official international standard which is not only well recognized by worldwide equipment user but also approved by international organization shall be referred to.

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 10-1000 Hz, > 600 rpm 2-1000 Hz, > 120 rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
Limit, mm/s, rms								
> 18.8								
11.8 - 18.8								
7.1 - 11.8								
4.5 - 7.1								
3.5 - 4.5								
2.8 - 3.5								
2.3 - 2.8								
1.6 - 2.3								
0.7 - 1.6								
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)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	≤ 0.56	> 0.56 - 1.41	> 1.41 - 5.08	> 5.08
1000	≤ 1.13	> 1.13 - 2.82	> 2.82 - 9.87	> 9.87
1500	≤ 1.68	> 1.68 - 3.95	> 3.95 - 11.28	> 11.28
3000	≤ 3.95	> 3.95 - 8.46	> 8.46 - 28.2	> 28.2

#### 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: **Stage D (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: **Stage C (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: **Stage B (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	
>14-28	>23-45	>23-45	>35-71	>14-28	>23-45	>23-45	>35-71	

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: **Stage A (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"

May 2025				
No.	Tag No.	Severity	Conclusion	Recommended
1	N-P-6871A	Stage C (Alarm)	<u>After overhaul pump.</u> <b>Engine:</b> Normal condition. <b>Gearbox/Pump:</b> Gear cannot record vibration data due to sensor alert overload limit.	<b>Engine:</b> Should be keep monitor trend of vibration and Peakvue mode in <u>routine interval.</u> <b>Pump:</b> Should be rechecked gearbox condition. (Inspect internal part condition such as gear backlash, Tolerance fitting lube oil condition, contamination etc.)

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.





## Vibration analysis report for GC7\_BTF Plant



Tag: N-P-6871A

Severity: N/A

Area: GC7\_BTF

Class: B

Machine name: FIRE WATER PUMP (DIESEL)

Date of data measurement: 20 May 2025

Main problem: After overhaul pump. Engine is normal condition. Gear cannot record vibration data due to sensor alert overload limit.

Inspected by: Sopon H.

Analyst by: Warut K.

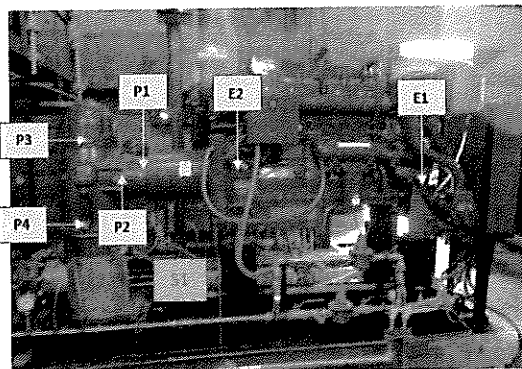
Review by: Warut K.

### Reference criteria

Standard		Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)	Unit
ISO-10816 part 6 (Engine)	Class V	≤14.1	>14.1 – 28.2	>28.2 – 44.6	>44.6	mm/S RMS
Statistical alarm velocity. (Pump)		≤28.0	>28.0 – 56.0	>56.0 – 65.5	>65.5	mm/S RMS
Statistical alarm Acceleration of Peakvue mode. (Engine)		≤16.25	>16.25 – 32.5	>32.5 – 40.5	>40.5	G's, PK-PK
Statistical alarm Acceleration of Peakvue mode. (Pump)		≤11.25	>11.25 – 22.5	>22.5 – 32.5	>32.5	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. Statistical alarm was calculated from historical measurement more than 10 times.

### Machine description and vibration measurement point



#### Engine

Manufacturer: CATERPILLAR

Type: DIESEL (CAT 3406C)

Power: 217-359 kw

Speed = 1,750-2,300 rpm

DE Bearing: N/A

NDE Bearing: N/A

#### Pump

Manufacturer: Bombas vertical gear pump

Type: N/A

Shaft input speed (P1,P2): 1,750-2,300 rpm

DE Bearing:

NDE Bearing:

Shaft output speed (P3,P4): N/A

DE Bearing: N/A

NDE Bearing: N/A

Tooth of Gear /High speed: N/A

Tooth of Gear /Low speed: N/A

GMF1 = N/A

**Vibration analysis**

▪ **Engine**

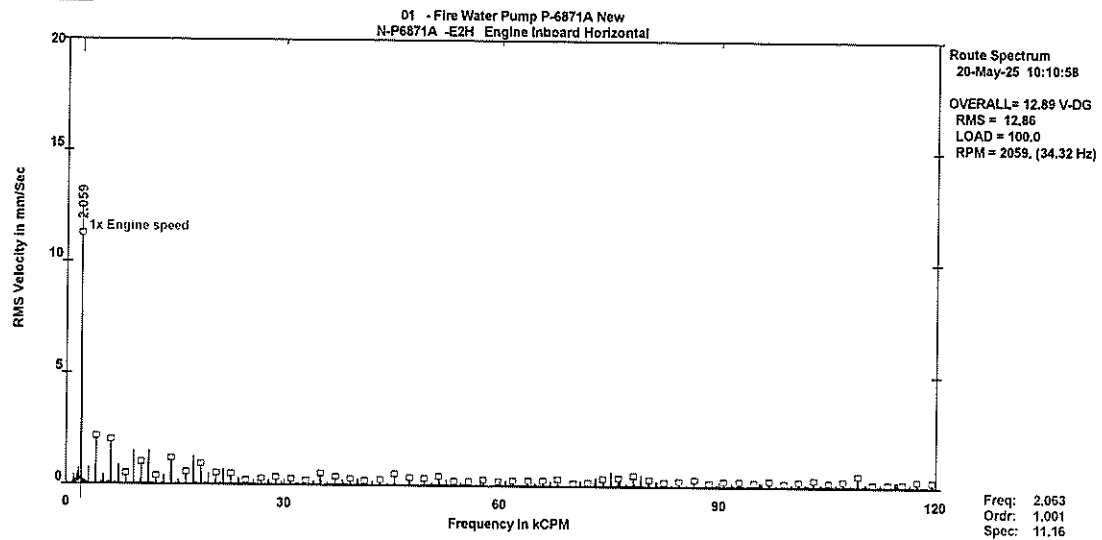


Fig1: Spectrum Plot Point E2: Diesel Engine – DE – Horizontal – Velocity. (New databased setup.)

▪ **Pump**

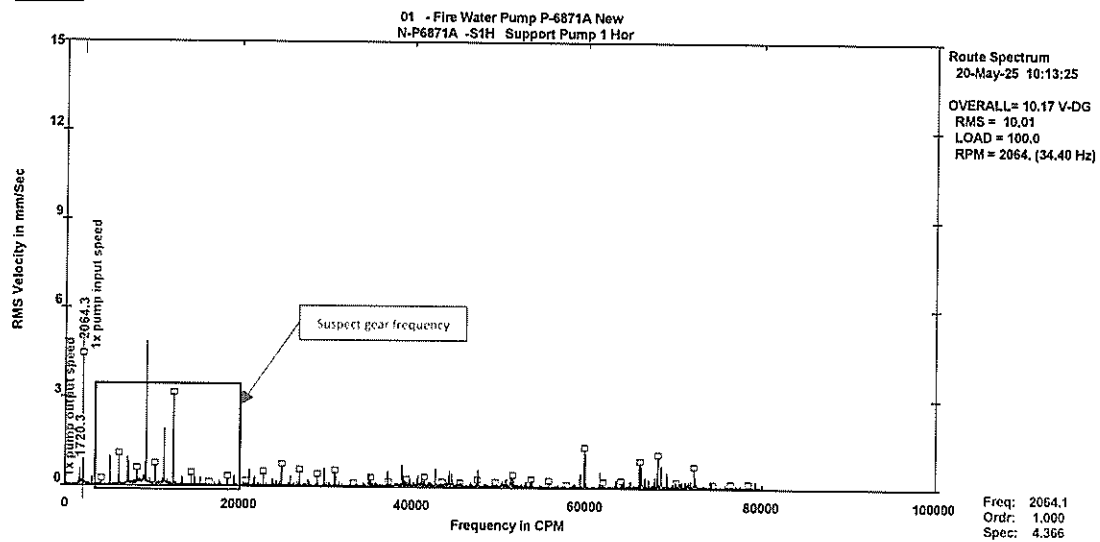


Fig2: Spectrum Plot Point S1: Support pump – Horizontal – Velocity. (New databased setup.)

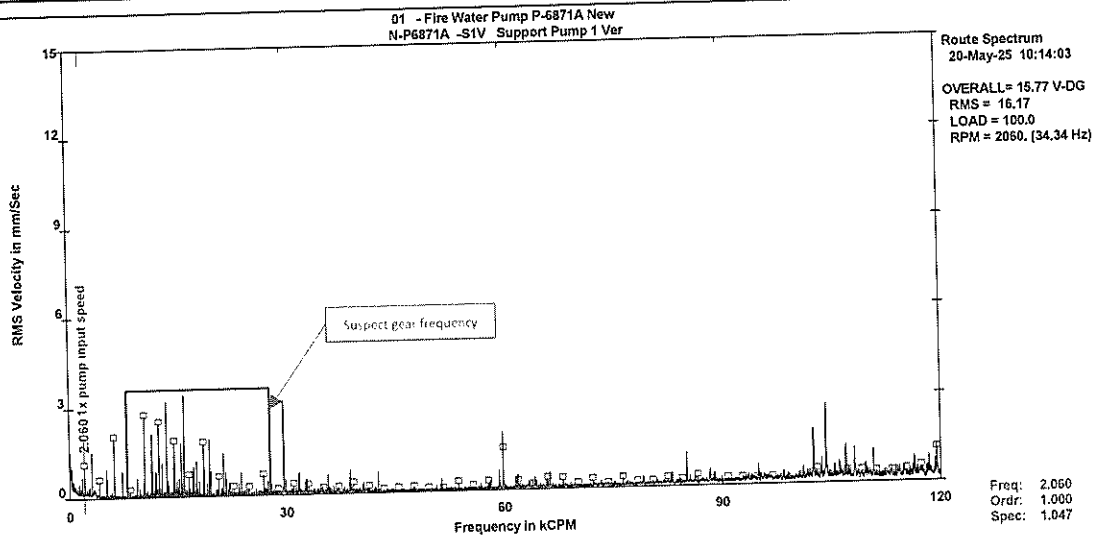


Fig3: Spectrum Plot Point S1: Support pump – Vertical – Velocity. (New databased setup.)

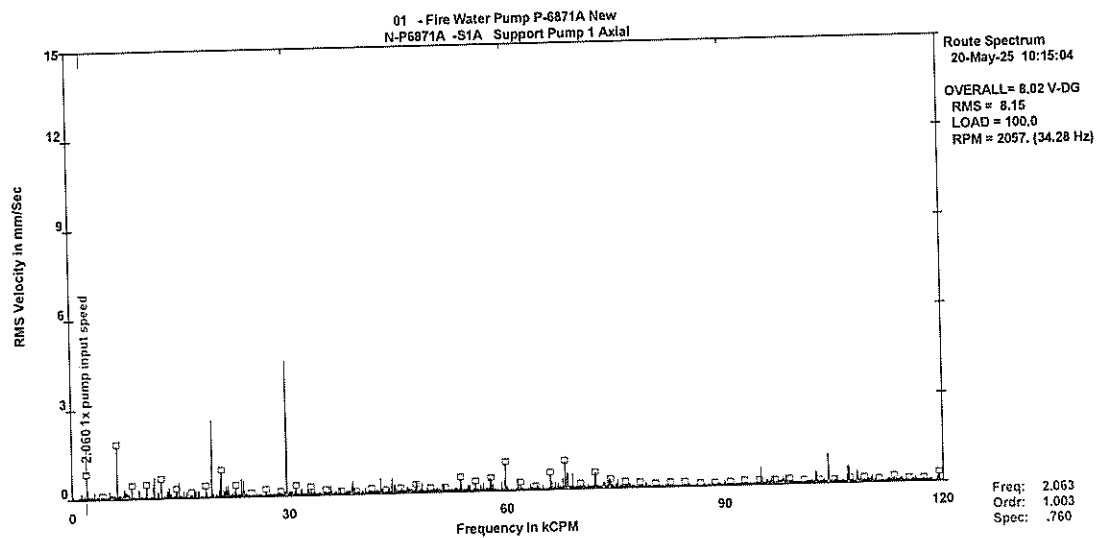


Fig4: Spectrum Plot Point S1: Support pump – Axial – Velocity. (New databased setup.)

**Inspection Finding**

- **Engine:** The overall velocity of vibration at point E2 Engine DE in horizontal direction was 12.89 mm/s, RMS and enter to "Stage A (Good)" severity by refer ISO 10816-6. The FFT spectrum shown dominant peak at 1x of engine speed and its harmonics also amplitude is in limit. Engine is in normal condition. (Fig 1)
- **Gearbox/Pump:** After overhaul pump.
  1. At gearbox cannot record vibration data due to sensor alert overload limit.
  2. The overall velocity of vibration at point S1 support pump in horizontal direction was 10.17 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of pump input speed and its harmonics. And shown FFT spectrum around 10,000 – 20,000 CPM suspect gear frequency. (Fig 2)
  3. The overall velocity of vibration at point S1 support pump in vertical direction was 15.77 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of pump input speed and its harmonics. And shown FFT spectrum around 10,000 – 20,000 CPM suspect gear frequency. (Fig 3)
  4. The overall velocity of vibration at point S1 support pump in axial direction was 8.02 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of pump input speed and its harmonics. (Fig 4)
  5. Can measurement vibration at support pump only.

**Conclusion**

- **Engine:** Normal condition.
- **Gearbox/Pump:** Gear cannot record vibration data due to sensor alert overload limit.

**Recommendation**

- **Engine :** Should be keep monitor trend of vibration and Peakvue mode in routine interval.
- **Pump :**
  1. Should be recheck gearbox condition. (Inspect internal part condition such as gear backlash, Tolerance fitting lube oil condition, contamination etc.)

## Appendix A Overall vibration

Database: GC7\_(BTF).rbm  
Area: GC7

MEASUREMENT POINT	OVERALL LEVEL
N-P6871A - Fire Water Pump P-6871A New (20-May-25)	
	OVERALL LEVEL
E1H - Engine Outboard Horizontal	8.816 mm/Sec
E1P - Engine Outboard Horz Peakvue	26.12 G-s
E1V - Engine Outboard Vertical	6.508 mm/Sec
E1A - Engine Outboard Axial	7.507 mm/Sec
E2H - Engine Inboard Horizontal	12.89 mm/Sec
E2P - Engine Inboard Horz Peakvue	11.16 G-s
E2V - Engine Inboard Vertical	6.588 mm/Sec
E2A - Engine Inboard Axial	7.146 mm/Sec
S1H - Support Pump 1 Hor	10.17 mm/Sec
S1P - Support Pump 1 Horz Peakvue	5.704 G-s
S1V - Support Pump 1 Ver	15.77 mm/Sec
S1A - Support Pump 1 Axial	8.020 mm/Sec

### Clarification Of Vibration Units:

Acc --> G-s P-P  
Vel --> mm/Sec RMS

## Appendix B

### Vibration Severity Listing

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

#### - **Stage A (Good)** Fault in low level:

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

#### - **Stage B (Fair)** Keeps Monitoring Failure Trend:

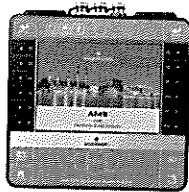
A vibration severity level that is readily achieved by the great majority of machine that is well designed and constructed.

#### - **Stage C (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.

#### - **Stage D (Danger)** Requires Immediate Attention:

Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

Appendix C: Data collection by CSI2140

Vibration Analyzer: CSI 2140 No.14

Serial No.: B21402218840

Calibration Date: 09-Aug-23

Calibration Due: 08-Aug-25

## **Appendix A: Severity of machine**

## GC7\_BTf Plant

No.	Eq. Tag	Name Machine	Machine Class	Interval	Jan-25	Feb-25	Mar-25	Apr-25	May-2025				May-25	VCMF
					Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	01May-10May	11May-20May	18May-26May	15May-31May	Summary of Severity	
1	N-B-6921-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	6-May-25			W21	Stage B (FAIR)	P
2	N-B-6921-01B	INSTRUMENT AIR COMPRESSOR B	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Stage B (FAIR)	6-May-25				Stage B (FAIR)	P
3	N-B-6921-01C	INSTRUMENT AIR COMPRESSOR C	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
4	N-B-6940-01	ETHYLENE UNLOADING COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
5	N-B-6940-101	PROPYLENE UNLOADING COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
6	N-B-6940-11	COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
7	N-B-6940-111	COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
8	N-EM-5302A	TRANSFER ETHYLENE VAPORIZER	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
9	N-EM-5302B	TRANSFER ETHYLENE VAPORIZER	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
10	N-EM-5302A	METHANOL HEATER MOTOR	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
11	N-EM-5303B	METHANOL HEATER MOTOR	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
12	N-EM-6940-01A	C2- PROCESS COOLING FAN MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
13	N-EM-6940-01B	C2- PROCESS COOLING FAN MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
14	N-EM-6940-101A	PROPYLENE PROCESS COOLER FAN MOTOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
15	N-EM-6940-101B	PROPYLENE PROCESS COOLER FAN MOTOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
16	N-G-6871	EMERGENCY GENERATOR 1025 KVA.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
17	N-P-5301A	TRANSFER ETHYLENE PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
18	N-P-5301R	TRANSFER ETHYLENE PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
19	N-P-5302A	METHANOL CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
20	N-P-5302R	METHANOL CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
21	N-P-6872A	FIRE WATER PUMP (DIESEL)	B	1M	Stage B (FAIR)	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
22	N-P-6871R	FIRE WATER PUMP (DIESEL)	B	1M	Stage C (ALARM)	Machine did not operate	Machine did not operate	Machine did not operate			20 May-25		Stage C (ALARM)	P
23	N-P-6872	FIRE WATER PUMP	B	1M	Stage A (GOOD)	Machine did not operate	Machine did not operate	Machine did not operate			20 May-25		Stage A (GOOD)	P
24	N-P-6873A	FOAM AGENT PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate			20 May-25		Machine did not operate	P
25	N-P-6873R	FOAM AGENT PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
26	N-P-6925-01A	FIRE FIGHTING WATER P. [MOTOR]	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	6-May-25				Machine did not operate	P
27	N-P-6925-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	6-May-25				Machine did not operate	P
28	N-P-6925-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	6-May-25				Machine did not operate	P
29	N-P-6925-02A	FIRE FIGHTING JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
30	N-P-6925-02R	FIRE FIGHTING JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
31	N-P-6945A	PROPYLENE TRANSFER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	6-May-25				Machine did not operate	P
32	N-P-6945B	PROPYLENE BOOSTER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
33	N-P-6945R	PROPYLENE TRANSFER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
34	N-P-6949A	METHANOL PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
35	N-P-6925-05	FIRE WATER PUMP 800 M3/Hr.	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
36	N-P-6925-07A	FIRE WATER PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P
37	N-P-6925-07B	FIRE WATER PUMP B	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	P



# GC7\_BTf Plant

GC7_BTf Plant					Jan-25	Feb-25	Mar-25	Apr-25	May-2025				May-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	W18	W19	W20	W21	Summary of Severity
38	N-G-6904	EMERGENCY GENERATOR 1100 KVA	S	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
39	N-GD-6914	Emergency Diesel Engine Generator	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
40	N-P-6966A	GAZ Transfer PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
41	N-P-6966B	MIXED CA PUMP (P-6966B)	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
42	N-P-6966R	CAR Transfer PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
43	N-P-6949-02A	MEOH PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
44	N-P-6949-02B	MEOH PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	8-May-25				Stage A (GOOD) Machine did not operate
45	N-BM-6923	FLARE BLOWER MOTOR	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
46	N-BM-111	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
47	N-BM-112	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
48	N-BM-113	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
49	N-BM-114	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
50	N-B-6903A	Compressor Chilled Water Package	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
51	N-B-6903R	Compressor Chilled Water Package	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
52	N-P-6903-01A	BD CIRCULATION PUMP	B	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
53	N-P-6903-01B	BD CIRCULATION PUMP	B	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	8-May-25				Stage A (GOOD) Machine did not operate
54	N-P-6903-01R	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
55	N-P-6903-02A	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
56	N-P-6903-02B	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
57	N-P-6903-02R	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
58	N-P-6903-03A	BD TRUCK PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
59	N-P-6903-03R	BD TRUCK PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
60	N-P-6903-04A	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
61	N-P-6903-04R	CHILLED WATER PUMP	B	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	8-May-25				Stage A (GOOD) Machine did not operate
62	N-P-6902A	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
63	N-P-6902R	BUTENE-1 TRANSFER PUMP	B	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
64	N-P-6901A	BUTENE-1/LPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	8-May-25				Stage B (Fair) Machine did not operate
65	N-P-6901R	BUTENE-1/LPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
66	N-P-6930-01	MEG BOOSTER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
67	N-BM-6925-01	MOTOR FOR BLOWER (SWRO)	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
68	N-BM-6925-02	MOTOR FOR BLOWER (SWRO)	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
69	N-P-6925-03	DIESEL FUEL PUMP	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
70	N-P-6925-04	FOAM AGENT PUMP	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
71	N-P-6925-06	DIESEL OIL PUMP	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
72	N-P-6940A	ETHYLENE TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
73	N-P-6940R	ETHYLENE TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
74	N-BPM-6940-01R	MOTOR FOR LUBE OIL PUMP 8-01R	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate

GC7_BTf Plant					Jan-25	Feb-25	Mar-25	Apr-25	May-2025				May-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity				Summary of Severity
					Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	W18 01May-10May	W19 11May-17May	W20 18May-24May	W21 15May-31May	Machine did not operate
75	N-BEH-6940-01	ETHYLENE FAN OIL COOLER MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
76	N-BEH-6940-101	FREON FAN OIL COOLER MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
77	N-BPM-6940-101R	MOTOR FOR LUBE OIL PUMP B-101R	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
78	N-P-6983-05	CHILLED WATER FEED PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
79	N-P-6983-06A	TBC INJECTION PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
80	N-P-6983-06R	TBC INJECTION PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
81	N-P-6961A	WATER SUPPLY PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
82	N-P-6961R	WATER SUPPLY PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
83	N-P-6874A	DIESEL FUEL TRANSFER PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
84	N-P-6874R	DIESEL FUEL TRANSFER PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
85	N-P-6875A	JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
86	N-P-6875R	JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
87	N-O-6771	J2 HYDRAULIC UNIT FOR MONITOR	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
88	N-O-6961	HYDRAULIC POWER UNIT (LOADING)	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
89	N-O-6761	J2 HYDRAULIC UNIT FOR I/A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
90	N-P-6931	EDC DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
91	N-P-6941	VCM DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
92	N-P-6951	NACH DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
93	N-P-6981	CHEMICAL WASTE DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate
Number of Inspected machine					13	10	8	12					13
													58

Stage A (GOOD)	Stage A : (Good): The vibration of newly commissioned machines would normally fall within this zone.
Stage B (FAIR)	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
Stage C (ALARM)	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the
Machine did not operate	Machine did not operate. Machine is in standby mode.
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 มิถุนายน 2568





# Vibration Report

Prepared for

**PTT Global Chemical Public Company Limited (GC7 BTF Plant)**  
**Month of Survey and Data Collection: June 2025**

Inspected by: CHAIWAT PAEWPOLSONG

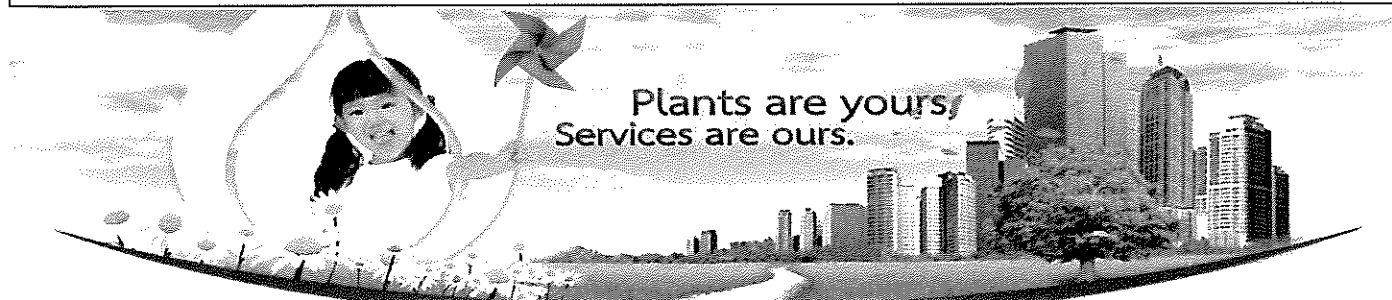
Reported by: WARUT KAUNBUMRUNG

Approved by: METEE MEERABEAB

## Condition Monitoring Service Integrity and Reliability Department

**GCME** 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: 17, 20 and 24 June 2025

Measurement plan 93 Equipment.

Checked 10 Equipment.

Machine did not operate 83 Equipment.

As show in Fig 1 And Table 1

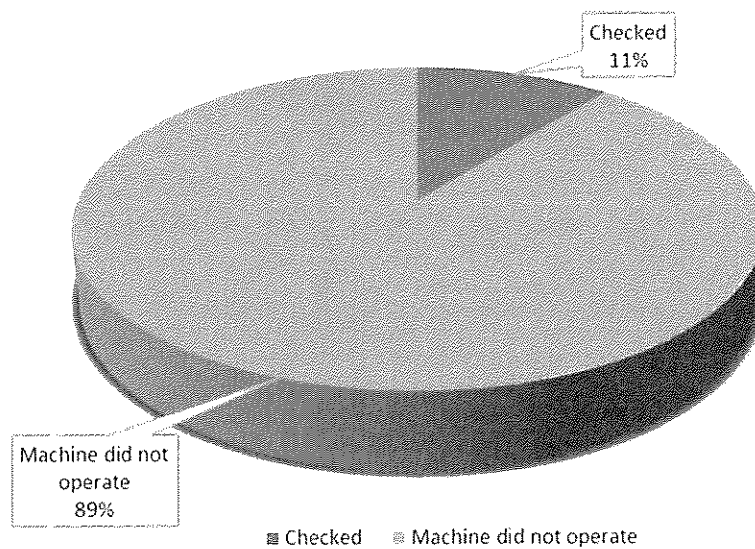
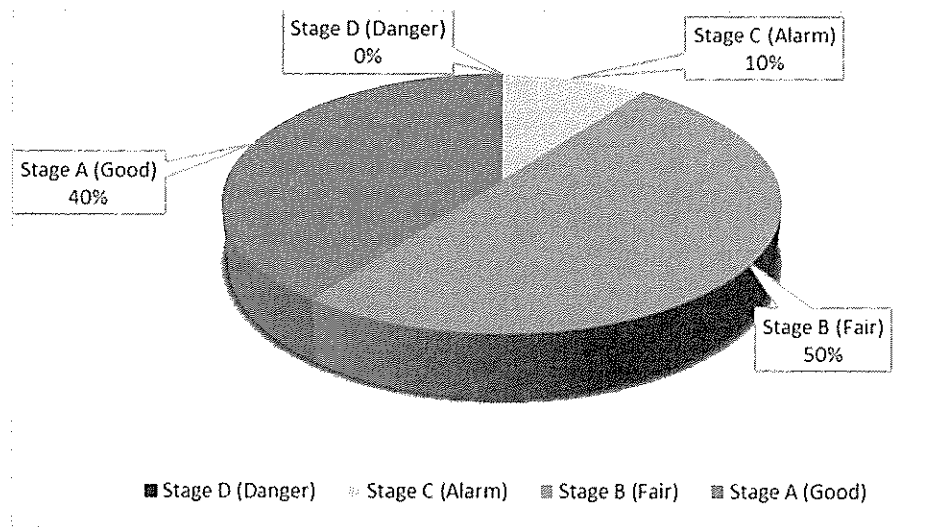


Fig 1

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

Item/Status	Measurement plan	Checked	Machine did not operate	Grand Total
Unit	93	10	83	93
Percentage	100%	11%	89%	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	Stage D (Danger)	Stage C (Alarm)	Stage B (Fair)	Stage A (Good)	Grand Total
Unit	0	1	5	4	10
Percentage	0%	10%	50%	40%	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 10 - 1000 Hz, $r > 600$ rpm 2 - 1000 Hz, $r > 120$ rpm	Pumps > 15 kW Radial, Axial, Mixed Flow				Medium Size Machines 15 kW < Power < 300 kW		Large Machines 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	
	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible
Limit, mm/s, rms								
> 18.8	D	D	D	D	D	D	D	D
11.0 - 18.8	D	D	D	D	D	D	D	D
7.1 - 11.0	D	C	D	C	D	C	D	C
4.5 - 7.1	D	C	C	B	D	C	C	B
3.5 - 4.5	C	B	B	B	C	B	B	B
2.8 - 3.5	C	B	B	A	C	B	B	A
2.5 - 2.8	B	B	B	A	B	B	B	A
1.4 - 2.5	B	A	A	A	B	A	A	A
0.7 - 1.4	A	A	A	A	A	A	A	A
0.0 - 0.7	A	A	A	A	A	A	A	A

	Newly Commissioned
	Unrestricted long-term operation
	Restricted long-term operation
	Vibration causes damage

### Vibration Peakvue Acceleration Severity

Speed of Machine (RPM)	G's, Pk-Pk			
	Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)
500	≤ 0.56	> 0.56 - 1.41	> 1.41 - 5.08	> 5.08
1000	≤ 1.13	> 1.13 - 2.82	> 2.82 - 9.87	> 9.87
1500	≤ 1.68	> 1.68 - 3.95	> 3.95 - 11.28	> 11.28
3000	≤ 3.95	> 3.95 - 8.46	> 8.46 - 28.2	> 28.2



#### 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: **Stage D (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: **Stage C (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, mms, 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: **Stage B (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	
>14-28	>23-45	>23-45	>35-71	>14-28	>23-45	>23-45	>35-71	

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: **Stage A (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"

June 2025				
No.	Tag No.	Severity	Conclusion	Recommended
1	N-P-6871A	Stage C (Alarm)	<u>Confirm vibration after overhaul pump.</u> <b>Engine:</b> Normal condition. <b>Gearbox/Pump:</b> Gear cannot record vibration data due to sensor alert overload limit. Suspect gear problem. (Mechanical looseness / worn gear problem.)	<b>Engine:</b> Should be keep monitor trend of vibration and Peakvue mode in <u>routine interval</u> . <b>Pump:</b> Should be rechecked gearbox condition. (Inspect internal part condition such as gear backlash, gear teeth condition, tolerance fitting, lube oil condition, contamination etc.) Or plan to overhaul gearbox.

## 6. Vibration Analysis Report

Any equipment whose vibration severity "Stage C (Alarm) and Stage D (Danger)" are explained an analysis detail separately. Please see each of them as attachment.

Tag: N-P-6871A

Machine name: FIRE WATER PUMP (DIESEL)

Inspected by: Sopon H.

Severity: Stage C (Alarm)

Date of data measurement: 20 June 2025

Analyst by: Warut K.

Area: GC7\_BTF

Class: B

**Main problem:** Confirm vibration. (After overhaul pump.) Engine is normal condition. Gear cannot record vibration data due to sensor alert overload limit. Suspect gear problem. (Mechanical looseness / worn gear problem.)

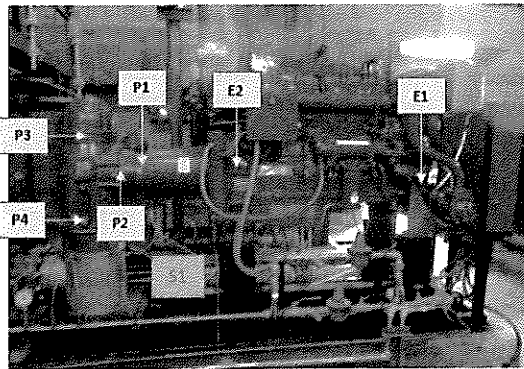
Review by: Warut K.

## Reference criteria

Standard		Stage A (GOOD)	Stage B (FAIR)	Stage C (ALARM)	Stage D (DANGER)	Unit
ISO-10816 part 6 (Engine)	Class V	≤14.1	>14.1 – 28.2	>28.2 – 44.6	>44.6	mm/s RMS
Statistical alarm velocity. (Pump)		≤18.0	>18.0 – 35.5	>35.5 – 53.5	>53.5	mm/s RMS

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. Statistical alarm was calculated from historical measurement more than 10 times.

## Machine description and vibration measurement point

	<b>Engine</b> Manufacturer: CATERPILLAR Type: DIESEL (CAT 3406C) Power: 217-359 kw Speed = 1,750-2,300 rpm DE Bearing: N/A NDE Bearing: N/A
	<b>Pump</b> Manufacturer: Bombas vertical gear pump Type: N/A Shaft input speed (P1,P2): 1,750-2,300 rpm DE Bearing: NDE Bearing: Shaft output speed (P3,P4): N/A DE Bearing: N/A NDE Bearing: N/A Tooth of Gear /High speed: N/A Tooth of Gear /Low speed: N/A GMF1 = N/A

## Vibration analysis

### Engine

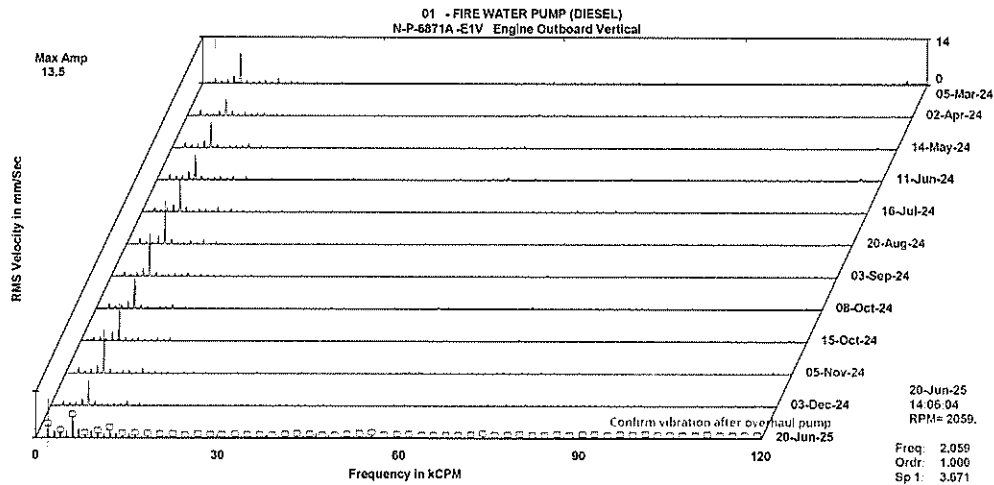
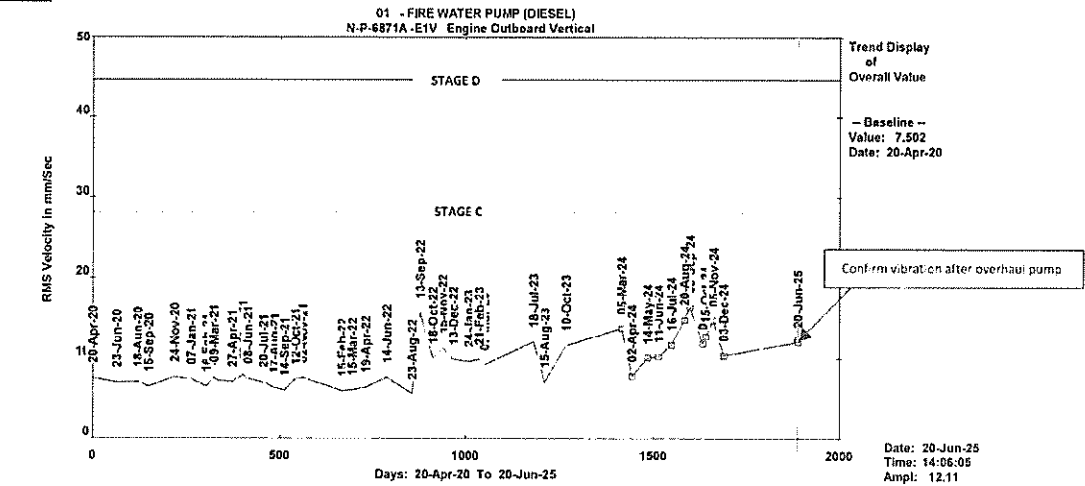
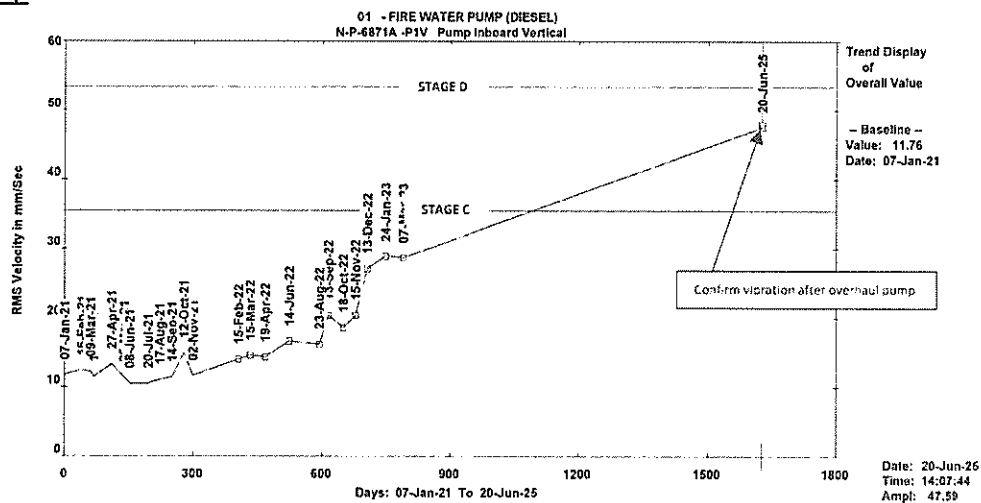


Fig1: Spectrum Plot Point E2: Diesel Engine – DE – Horizontal – Velocity. (New databased setup.)

### Pump



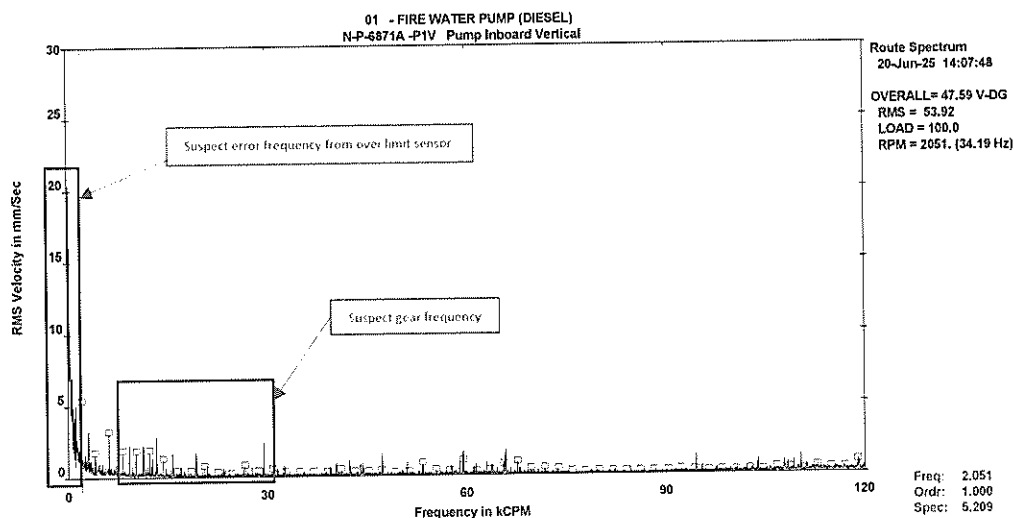
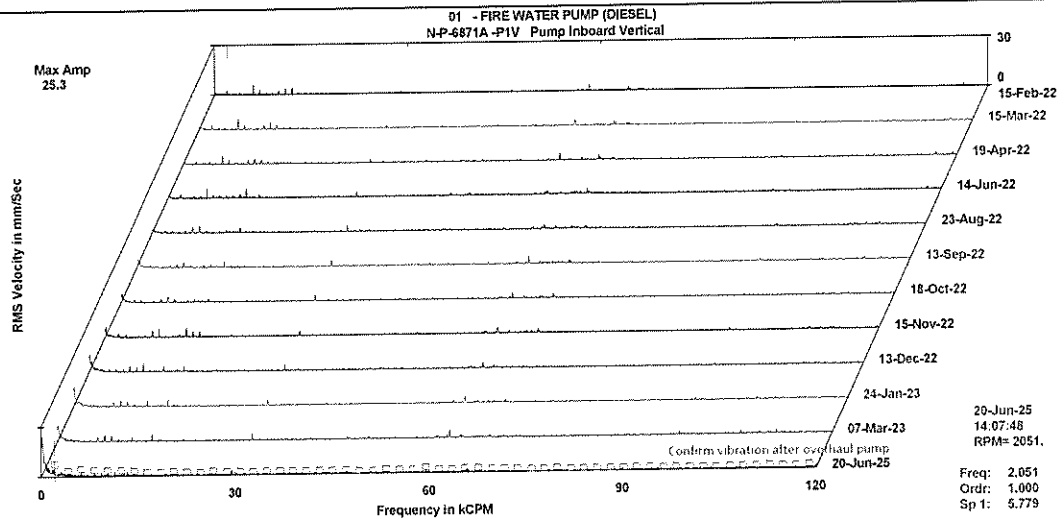


Fig2: Trend/Waterfall/Spectrum Plot Point P1: Gear Input shaft – DE - Vertical – Velocity.

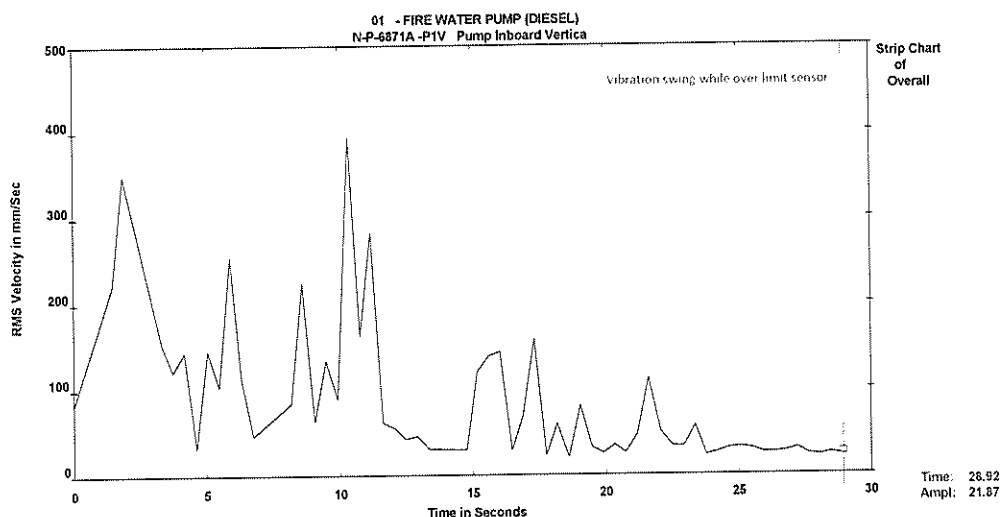
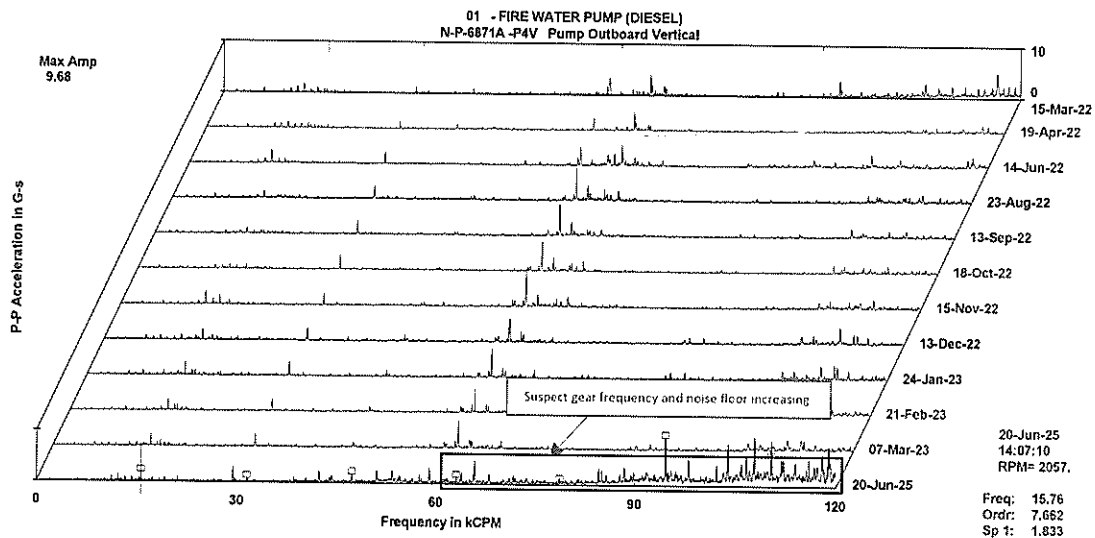
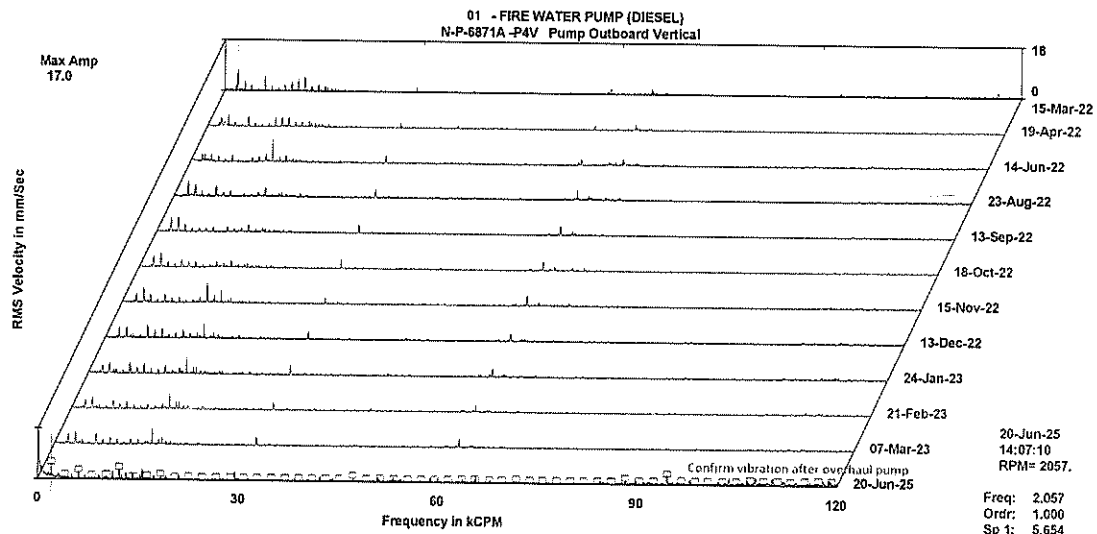
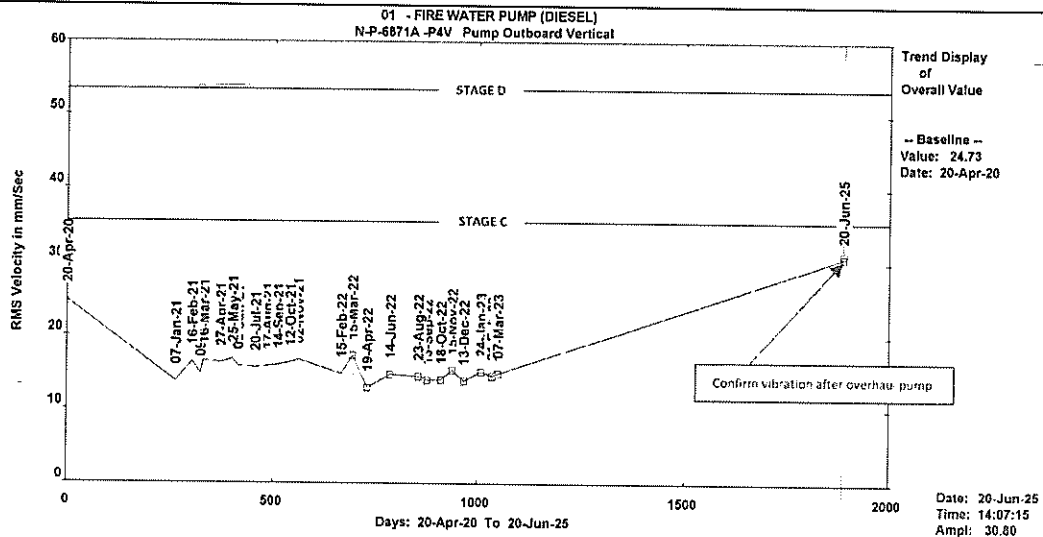


Fig3: Overall vibration of continuous recording at point P1 – Gear input shaft – DE - Vertical - Velocity.



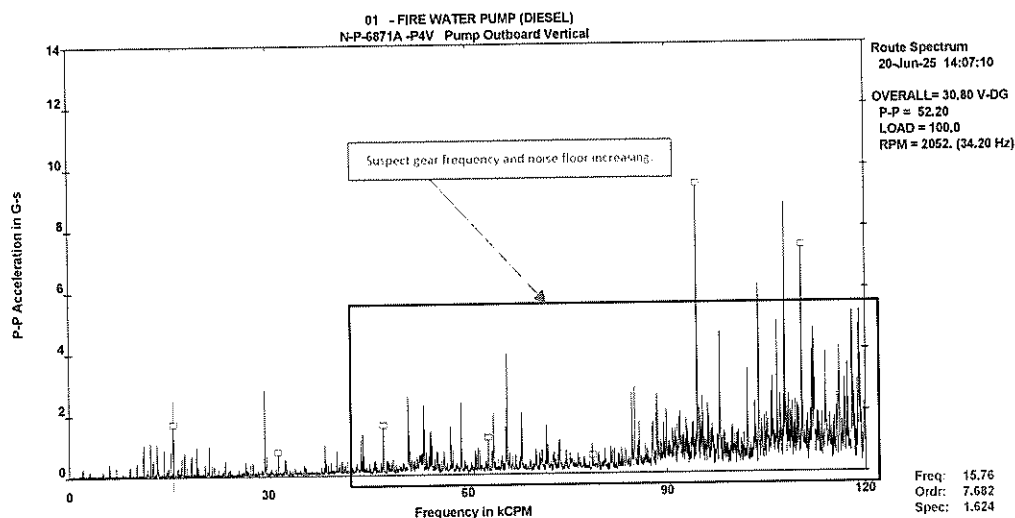
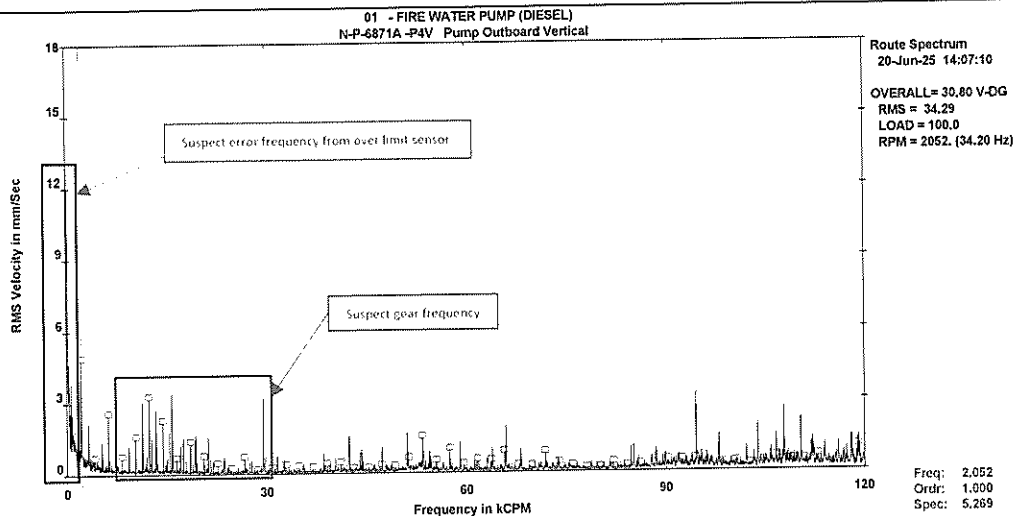


Fig4: Trend/Waterfall/Spectrum Plot Point P4: Gear Output shaft – NDE - Vertical – Velocity.

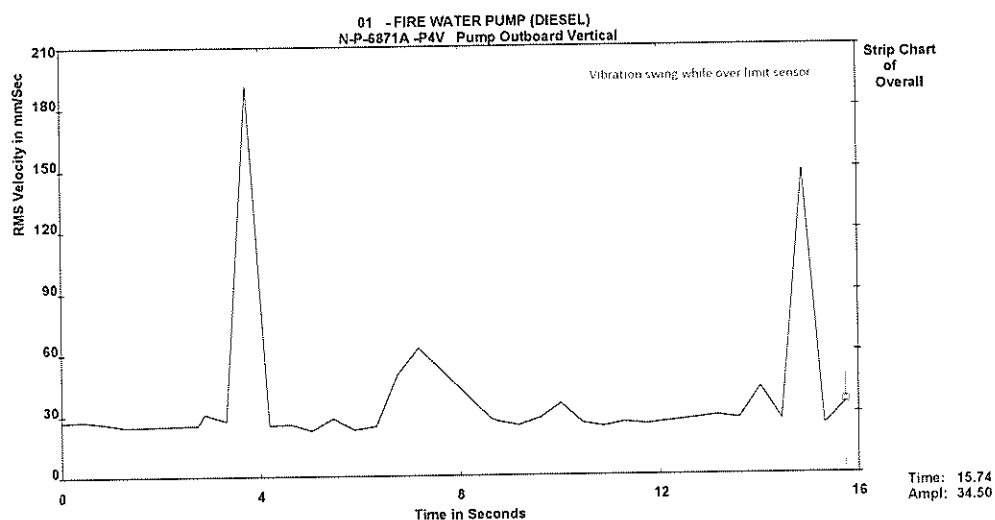


Fig5: Overall vibration of continuous recording at point P4 – Gear output shaft – NDE – Vertical - Velocity.



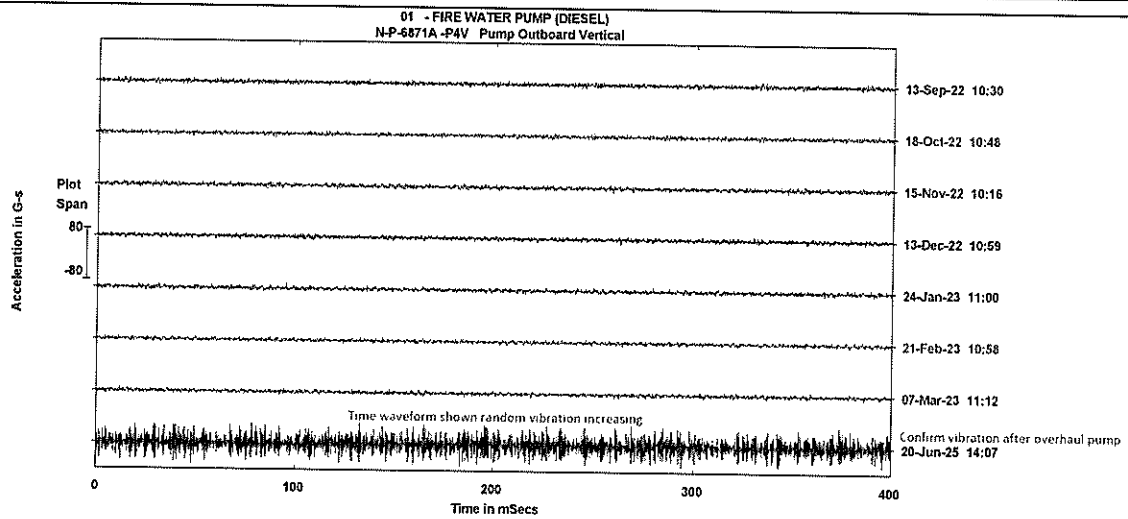
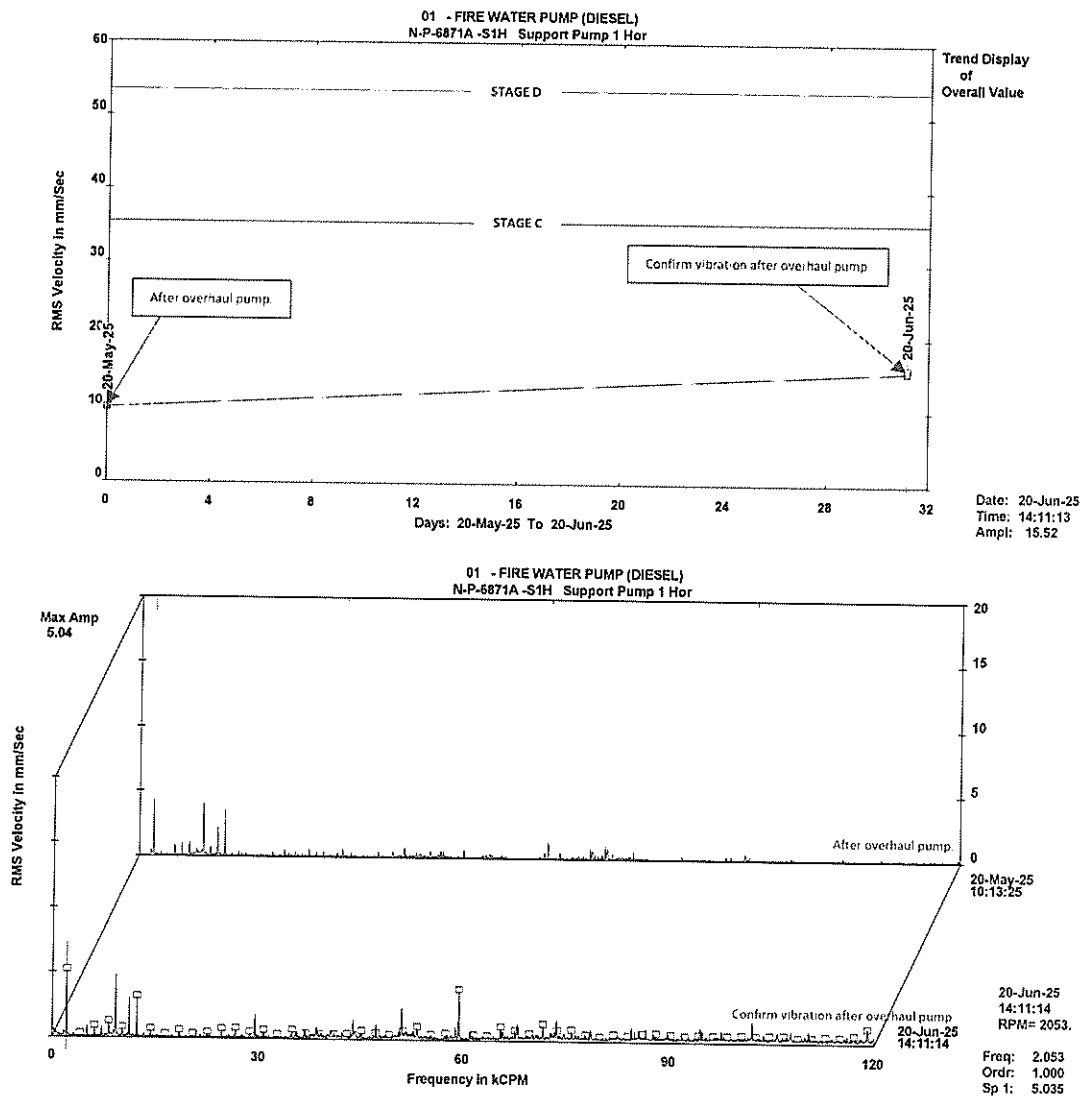


Fig6: Waterfall/Time Waveform Plot at P4: Gear output – NDE – Vertical – Acceleration.



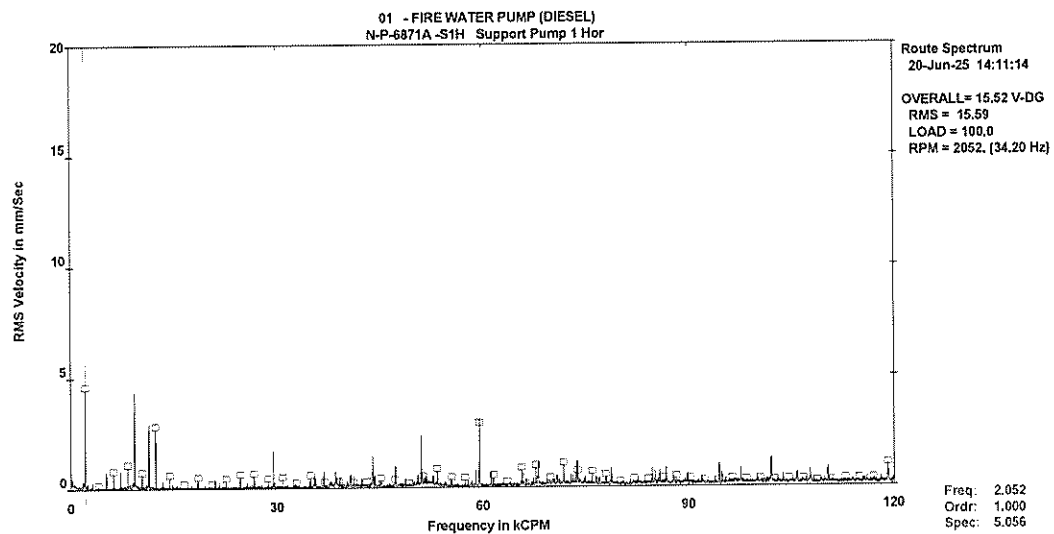
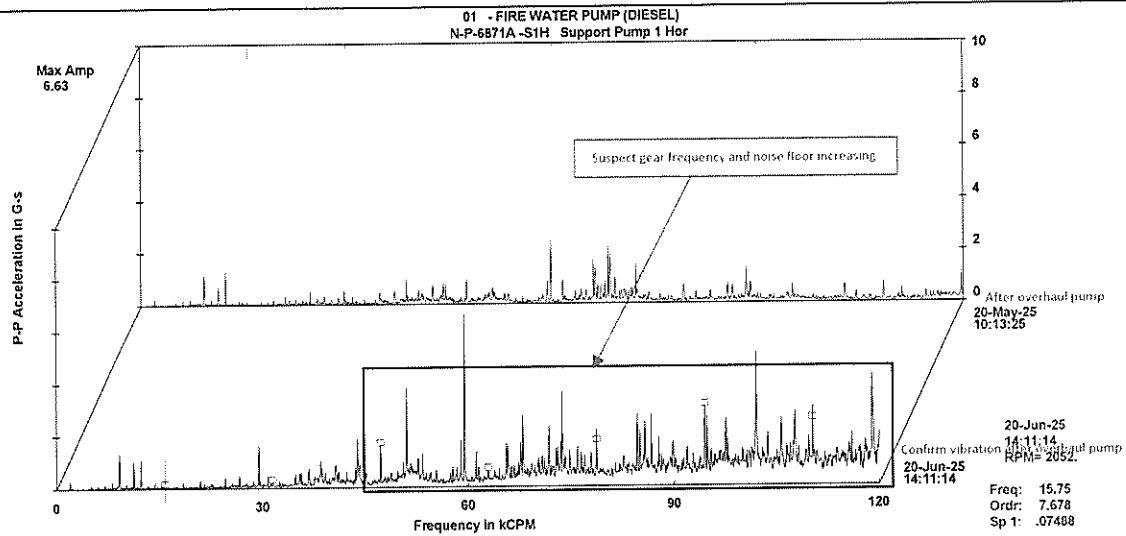


Fig7: Trend/Waterfall/Spectrum Plot Point S1: Support pump – Horizontal – Velocity.

## Inspection Finding

- **Engine:** The overall velocity of vibration at point E2 Engine DE in horizontal direction was 12.11 mm/s, RMS and enter to "Stage A (Good)" severity by refer ISO 10816-6. The FFT spectrum shown dominant peak at 1x of engine speed and its harmonics also amplitude is in limit. The engine is in normal condition. (Fig 1)
- **Gearbox/Pump:** Confirm vibration after overhaul pump.
  1. At gearbox while recorded vibration find sensor alert overload limit.
  2. The overall velocity of vibration at point P1 gear input shaft DE in vertical direction was 47.59 mm/s, RMS and enter to "Stage C (Alarm)" severity by refer statistical alarm. The FFT spectrum showed a dominant peak at 1x of gear input speed and its harmonics. And showed FFT spectrum around 10,000 – 20,000 CPM suspect gear frequency. The FFT spectrum shown below 1x suspected indicate to sensor alert overload limit. (Fig 2)
  3. The overall velocity of vibration while continuously recorded at point P1 gear input shaft DE in vertical direction found vibration swing around 22.0 (lowest) to 400.00 (highest) mm/s, RMS. Resulting in over limit of sensor. (Fig 3)
  4. The overall velocity of vibration at point P4 gear output shaft NDE in vertical direction was 30.80 mm/s, RMS The FFT spectrum showed a dominant peak at 1x of gear input speed and its harmonics. And showed FFT spectrum around 10,000 – 20,000 CPM suspect gear frequency. And FFT spectrum at 90,000 – 120,000 CPM shown increasing of noise floor suspect gear problem. The FFT spectrum shown below 1x suspected indicate to sensor alert overload limit. (Fig 4)
  5. The overall velocity of vibration while continuously recorded at point P4 gear output shaft NDE in vertical direction found vibration swing around 30.0 (lowest) to 200.0 (highest) mm/s, RMS. Resulting in over limit of sensor. (Fig 5)
  6. The time waveform plot at point P4 gear output shaft NDE in vertical direction shown increasing of random vibration which induced increasing of noise floor in FFT spectrum suspect gear problem. (Fig 6)
  7. The overall velocity of vibration at point S1 supports pump in horizontal direction increasing slightly from 10.17 to 15.52 mm/s, RMS. The FFT spectrum shown dominant peak at 1x of pump input speed and its harmonics. And shown FFT spectrum around 10,000 – 20,000 CPM suspect gear frequency. (Fig 7)
  8. Found abnormal noise (very roundly) around gear input shaft on site.
  9. Found sensor moving while mounting sensor on point P1 gear input shaft DE in horizontal direction for data sampling vibration.

## Conclusion

- **Engine:** Normal condition.
- **Gearbox/Pump:** Gear cannot record vibration data due to sensor alert overload limit. Suspect gear problem. (Mechanical looseness / worn gear problem.)

## Recommendation

- **Engine:** Should be keep monitor trend of vibration and Peakvue mode in routine interval.
- **Pump:**
  1. Should be recheck gearbox condition. (Inspect internal part condition such as gear backlash, gear teeth condition, tolerance fitting, lube oil condition, contamination etc.) Or plan to overhaul gearbox.

## Appendix A Overall vibration

Database: GC7 (BTF).rbm  
Area: GC7  
Period Reported: 03-Sep-24 To 23-Jun-25

Equipment 1: FIRE WATER PUMP (DIESEL)

	DATE	TIME	OVERALL
-----			
N-P-6871A - E1H-Engine Outboard Horizontal			mm/Sec
	03-Sep-24	14:16	11.54
	08-Oct-24	15:47	11.02
	05-Nov-24	14:26	9.773
	03-Dec-24	10:16	8.936
	20-Jun-25	14:05	11.02 --> Confirm vibration after overhaul pump.
N-P-6871A - E1P-Engine Outboard Horz Peakvue			G-s
	03-Sep-24	14:16	15.39
	08-Oct-24	15:47	23.59
	05-Nov-24	14:26	23.03
	03-Dec-24	10:16	24.64
	20-Jun-25	14:05	19.48
N-P-6871A - E1V-Engine Outboard Vertical			mm/Sec
	03-Sep-24	14:17	16.36
	08-Oct-24	15:47	11.83
	05-Nov-24	14:27	14.68
	03-Dec-24	10:16	10.33
	20-Jun-25	14:06	12.11
N-P-6871A - E1A-Engine Outboard Axial			mm/Sec
	03-Sep-24	14:17	5.779
	08-Oct-24	15:48	8.277
	05-Nov-24	14:27	8.790
	03-Dec-24	10:16	7.748
	20-Jun-25	14:06	5.416
N-P-6871A - E2H-Engine Inboard Horizontal			mm/Sec
	03-Sep-24	14:18	11.53
	08-Oct-24	15:48	15.81
	05-Nov-24	14:27	14.08
	03-Dec-24	10:17	12.13
	20-Jun-25	14:06	10.97
N-P-6871A - E2P-Engine Inboard Horz Peakvue			G-s
	03-Sep-24	14:18	8.593
	08-Oct-24	15:48	10.63
	05-Nov-24	14:27	10.50
	03-Dec-24	10:17	11.09
	20-Jun-25	14:06	12.46
N-P-6871A - E2V-Engine Inboard Vertical			mm/Sec
	03-Sep-24	14:18	18.39
	08-Oct-24	15:49	15.52
	05-Nov-24	14:27	16.50
	03-Dec-24	10:17	11.58
	20-Jun-25	14:07	9.578
N-P-6871A - E2A-Engine Inboard Axial			mm/Sec
	03-Sep-24	14:18	4.777
	08-Oct-24	15:49	5.055
	05-Nov-24	14:28	5.290
	03-Dec-24	10:17	5.644
	20-Jun-25	14:07	4.236

N-P-6871A - P1H-Pump Inboard Horizontal			
	20-Jun-25 14:01	mm/Sec	41.28 --> Confirm vibration after overhaul pump.
N-P-6871A - P1P-Pump Inboard Horz Peakvue		G-s	
	20-Jun-25 14:01	38.51	
N-P-6871A - P1V-Pump Inboard Vertical		mm/Sec	
	20-Jun-25 14:07	47.59	
N-P-6871A - P2H-Pump Outboard Horizontal		mm/Sec	
	20-Jun-25 14:03	32.48	
N-P-6871A - P2P-Pump Outboard Horz Peakvue		G-s	
	20-Jun-25 14:03	39.76	
N-P-6871A - P2V-Pump Outboard Vertical		mm/Sec	
	20-Jun-25 14:03	21.54	
N-P-6871A - P2A-Pump Outboard Axial		mm/Sec	
	20-Jun-25 14:05	19.11	
N-P-6871A - P3H-Pump Inboard Horizontal		mm/Sec	
	20-Jun-25 14:05	26.99	
N-P-6871A - P3P-Pump Inboard Horz Peakvue		G-s	
	20-Jun-25 14:05	36.92	
N-P-6871A - P3V-Pump Inboard Vertical		mm/Sec	
	20-Jun-25 14:06	16.95	
N-P-6871A - P3A-Pump Inboard Axial		mm/Sec	
	20-Jun-25 14:06	14.52	
N-P-6871A - P4H-Pump Outboard Horizontal		mm/Sec	
	20-Jun-25 14:06	18.68	
N-P-6871A - P4P-Pump Outboard Horz Peakvue		G-s	
	20-Jun-25 14:06	30.57	
N-P-6871A - P4V-Pump Outboard Vertical		mm/Sec	
	20-Jun-25 14:07	30.80	
N-P-6871A - P4A-Pump Outboard Axial		mm/Sec	
	20-Jun-25 14:07	16.03	
N-P-6871A - S1H-Support Pump 1 Hor		mm/Sec	
	20-May-25 10:13	10.17 --> After overhaul pump.	
	20-Jun-25 14:11	15.52	
N-P-6871A - S1P-Support Pump 1 Horz Peakvue		G-s	
	20-May-25 10:13	5.704	
	20-Jun-25 14:11	13.73	
N-P-6871A - S1V-Support Pump 1 Ver		mm/Sec	
	20-May-25 10:14	15.77	
	20-Jun-25 14:11	12.77	
N-P-6871A - S1A-Support Pump 1 Axial		mm/Sec	
	20-May-25 10:15	8.020	
	20-Jun-25 14:12	8.326	

## N-P-6871A - T1 -Temp engine NDE

		C
03-Sep-24	14:23	87.10
08-Oct-24	15:57	87.00
05-Nov-24	14:33	80.00
03-Dec-24	10:19	75.00
20-Jun-25	14:08	67.00

## N-P-6871A - T2 -Temp engine DE

		C
03-Sep-24	14:23	88.40
08-Oct-24	15:57	89.00
05-Nov-24	14:33	86.00
03-Dec-24	10:19	88.00
20-Jun-25	14:08	80.00

## N-P-6871A - T3 -Temp pump DE

		C
03-Sep-24	14:23	44.10
08-Oct-24	15:57	42.00
05-Nov-24	14:33	35.00
03-Dec-24	10:19	34.00
20-Jun-25	14:08	40.00

## N-P-6871A - T4 -Temp pump NDE

		C
03-Sep-24	14:24	52.70
08-Oct-24	15:57	53.00
05-Nov-24	14:33	48.00
03-Dec-24	10:19	40.00
20-Jun-25	14:08	39.00

## N-P-6871A - T5 -Temp pump DE

		C
03-Sep-24	14:24	40.10
08-Oct-24	15:57	41.00
05-Nov-24	14:33	49.00
03-Dec-24	10:19	33.00
20-Jun-25	14:08	32.00

## N-P-6871A - T6 -Temp pump NDE

		C
03-Sep-24	14:24	31.00
08-Oct-24	15:58	32.00
05-Nov-24	14:33	32.00
03-Dec-24	10:19	33.00
20-Jun-25	14:08	31.00

## N-P-6871A - DP -Discharge pressure

		Bar
03-Sep-24	14:24	13.50
08-Oct-24	15:57	13.50
05-Nov-24	14:34	13.50
03-Dec-24	10:20	12.00
20-Jun-25	14:09	12.00

## N-P-6871A - Sp -Speed

		Rpm
03-Sep-24	14:25	2093.0
08-Oct-24	15:57	2093.0
05-Nov-24	14:34	2097.0
03-Dec-24	10:20	2098.0
20-Jun-25	14:09	2054.0

### Clarification Of Vibration Units:

Acc	-->	G-s	P-P
Vel	-->	mm/Sec	RMS

## Appendix B

### Vibration Severity Listing

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

- **Stage A (Good)** Fault in low level:

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

- **Stage B (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.

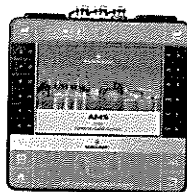
- **Stage C (Alarm)** Requires Attention at Next Opportunity:

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.

- **Stage D (Danger)** Requires Immediate Attention:

Vibration values within this zone are normally considered to be of sufficient severity to cause damage to the machine.

### Appendix C: Data collection by CSI2140



Vibration Analyzer: CSI 2140 No.14

Serial No.: B21402218840

Calibration Date: 09-Aug-23

Calibration Due: 08-Aug-25

## **Appendix A: Severity of machine**



GC7\_BTf Plant

No.	Eq. Tag	Name Machine	Machine Class	Interval	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-2025				Jun-25	Jun-25
					Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	Summary of Severity	VCMF	W22	W23	W24	W25	Summary of Severity
1	N-B-6021-01A	INSTRUMENT AIR COMPRESSOR A	B	1M	Machine did not operate	Stage B (FAIR)	Machine did not operate	Stage B (FAIR)	Stage B (FAIR)	P					Machine did not operate
2	N-B-6021-01B	INSTRUMENT AIR COMPRESSOR B	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Stage B (FAIR)	Stage B (FAIR)	P					Machine did not operate
3	N-B-6021-01C	INSTRUMENT AIR COMPRESSOR C	B	1M	Stage B (FAIR)	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P			17-Jun-25		Stage B (FAIR)
4	N-B-6040-01	ETHYLENE UNLOADING COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
5	N-B-6040-101	FREON UNLOADING COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
6	N-B-6040-11	COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
7	N-B-6040-111	COMPRESSOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
8	N-EM-5302A	TRANSFER ETHYLENE VAPORIZER	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
9	N-EM-5302B	TRANSFER ETHYLENE VAPORIZER	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
10	N-EM-5303A	METHANOL HEATER MOTOR	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
11	N-EM-5303B	METHANOL HEATER MOTOR	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
12	N-EM-6040-01A	C2- PROCESS COOLING FAN MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
13	N-EM-6040-01B	C2- PROCESS COOLING FAN MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
14	N-EM-6040-101A	FREON PROCESS COOLER FAN MOTOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
15	N-EM-6040-101B	FREON PROCESS COOLER FAN MOTOR	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
16	N-G-6071	EMERGENCY GENERATOR 1025 KVA.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
17	N-P-5301A	TRANSFER ETHYLENE PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
18	N-P-5301R	TRANSFER ETHYLENE PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
19	N-P-5302A	METHANOL CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
20	N-P-5302R	METHANOL CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
21	N-P-6071A	FIRE WATER PUMP (DIESEL)	B	1M	Stage A (FAIR)	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
22	N-P-6071R	FIRE WATER PUMP (DIESEL)	B	1M	Stage C (ALARM)	Machine did not operate	Machine did not operate	Machine did not operate	Stage C (ALARM)	P				20-Jun-25	Stage C (ALARM)
23	N-P-6072	FIRE WATER PUMP	B	1M	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	Stage A (GOOD)	P				24-Jun-25	Stage A (GOOD)
24	N-P-6073A	FOAM AGENT PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P				24-Jun-25	Stage A (GOOD)
25	N-P-6073R	FOAM AGENT PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
26	N-P-6025-01A	FIRE FIGHTING WATER P. (MOTOR)	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	P			17-Jun-25		Stage B (FAIR)
27	N-P-6025-01B	FIRE WATER PUMP DIESEL ENGINE B	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	P			17-Jun-25		Stage B (FAIR)
28	N-P-6025-01R	FIRE WATER PUMP DIESEL ENGINE R	S	1M	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	Stage B (FAIR)	P			17-Jun-25		Stage B (FAIR)
29	N-P-6025-02A	FIRE FIGHTING JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
30	N-P-6025-02R	FIRE FIGHTING JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
31	N-P-6045A	PROPYLENE TRANSFER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
32	N-P-6045B	PROPYLENE BOOSTER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
33	N-P-6045R	PROPYLENE TRANSFER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
34	N-P-6049A	METHANOL PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
35	N-P-6025-05	FIRE WATER PUMP 800 M3/hr.	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
36	N-P-6025-07A	FIRE WATER PUMP A	S	1M	Stage A (GOOD)	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P					Machine did not operate
37	N-P-6025-07B	FIRE WATER PUMP B	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	P			17-Jun-25		Stage B (FAIR)

GC7_BTF Plant										Jun-2025				Jun-25	Jun-25
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity	Mar-25	Apr-25	May-25	VCMP	W22	W23	W24	W25	Summary of Severity	VCMP
38	N-G-6904	EMERGENCY GENERATOR 1100 KVA.	S	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
39	N-CD-6914	Emergency Diesel Engine Generator	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
40	N-P-6956A	CAR Transfer PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
41	N-P-6956B	MIXED C4 PUMP (P-6956B)	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
42	N-P-6956R	CAR Transfer PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
43	N-P-6949-02A	MEOH PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
44	N-P-6949-02B	MEOH PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
45	N-BM-6923	FLARE BLOWER MOTOR	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
46	N-BM-111	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
47	N-BM-112	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
48	N-BM-113	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
49	N-BM-114	Blower Flare	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
50	N-B-6983A	Compressor Chilled Water Package	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
51	N-B-6983R	Compressor Chilled Water Package	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
52	N-P-6983-01A	BD CIRCULATION PUMP	B	1M	Stage A (GOOD) Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
53	N-P-6983-01B	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
54	N-P-6983-01R	BD CIRCULATION PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
55	N-P-6983-02A	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
56	N-P-6983-02B	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
57	N-P-6983-02R	BD TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
58	N-P-6983-03A	BD TRUCK PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
59	N-P-6983-03R	BD TRUCK PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
60	N-P-6983-04A	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
61	N-P-6983-04R	CHILLED WATER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
62	N-P-6982A	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
63	N-P-6982R	BUTENE-1 TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
64	N-P-6981A	BUTENE-1/JPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
65	N-P-6981R	BUTENE-1/JPG TRANSFER PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
66	N-P-6930-01	MES BOOSTER PUMP	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
67	N-BM-6925-01	MOTOR FOR BLOWER (SWRO)	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
68	N-BM-6925-02	MOTOR FOR BLOWER (SWRO)	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
69	N-P-6925-03	DIESEL FUEL PUMP	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					Machine did not operate	
70	N-P-6925-04</														

# GC7\_BTf Plant

GC7__BTF Plant					Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-2025	Jun-25	Jan-25	
No.	Eq. Tag	Name Machine	Machine Class	Interval	Summary of Severity				Summary of Severity	VCMF	Summary of Severity	VCMF	
					Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate					
75	N-BEM-6940-01	ETHYLENE FAN OIL COOLER MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
76	N-BEM-6940-101	FRCON FAN OIL COOLER MOTOR.	A	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
77	N-BPM-6940-101R	MOTOR FOR LUBE OIL PUMP B-101R	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
78	N-P-6983-05	CHILLED WATER FEED PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
79	N-P-6983-06A	TBC INJECTION PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
80	N-P-6983-06R	TBC INJECTION PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
81	N-P-6861A	WATER SUPPLY PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
82	N-P-6861R	WATER SUPPLY PUMP	C	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
83	N-P-6874A	DIESEL FUEL TRANSFER PUMP A	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
84	N-P-6874R	DIESEL FUEL TRANSFER PUMP R	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
85	N-P-6875A	JOCKEY PUMP A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
86	N-P-6875R	JOCKEY PUMP R	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
87	N-O-6771	J2 HYDRAULIC UNIT FOR MONITOR	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
88	N-O-6861	HYDRAULIC POWER UNIT (LOADING)	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
89	N-O-6761	J2 HYDRAULIC UNIT FOR U/A	S	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
90	N-P-6831	EDC DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
91	N-P-6841	VCM DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
92	N-P-6851	NACN DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
93	N-P-6861	CHEMICAL WASTE DRAIN PUMP	B	1M	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate	Machine did not operate		Machine did not operate	P	P
Number of inspected machine					13	10	8	12	13	93	10	93	

Stage A (GOOD)	Stage A : Good: The vibration of newly commissioned machines would normally fall within this zone.
Stage B (FAIR)	Stage B : (Allowable): Machines with vibration within this zone are normally considered acceptable for unrestricted long-term operation.
Stage C (ALARM)	Stage C : (Just tolerable): Machines with vibration within this zone are normally considered unsatisfactory for long-term continuous operation. Generally, the
Machine did not operate	Machine did not operate. Machine is in standby mode.
Out of service	Out of service : Cannot measure due to machine do not run as a result of machine overhaul to repair inacceptable 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 on long term.