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| Vibration diagnostic report **4948U-2023** | | |
| Project: **BW Tiger**  IMO no: **9635846**  Ordered by: **BW Group** | Date of measurement:   **2023-03-24 - 2023-03-31** | Place of measurement:  **During normal operation** |

Measurement condition

Measurements were taken during normal operating condition.

Results presentation

Measured values are presented in the table below. Each machine if applicable is separated for driver (el. motor, diesel engine, etc.) and driven unit (pump, compressor, etc.). *First column* of the table consist name of the equipment. *Second column* contains the highest value of vibration velocity measured on the equipment in all measurement points. *Third column* contains classification of the vibration class according to proper ISO standard and other normative documents. Classification depends on highest reading of measured equipment only. *Fourth column* contains additional readings of enveloped value of acceleration, which is helpful in detection of early stage of bearing wear. *Fifth column* contains remarks and suggestions based on the analysis of vibration signal. This column can be taken as the final conclusion about machine condition. If cell is empty, it means that there is no existing problem or defect shown in vibration signal.

Vibration standards

Following standards may applied for assessment:

|  |  |
| --- | --- |
| **ISO 10816-3** | Mechanical vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 3: Industrial machines with nominal power above 15 kW and nominal speeds between 120 r/min and 15 000 r/min when measured in situ |
| **ISO 10816-6** | Mechanical vibration - Evaluation of machine vibration by measurements on nonrotating parts - Part 6: Reciprocating machines with power ratings above 100 kW |
| **ISO 10816-7** | Mechanical vibration — Evaluation of machine vibration by measurements on non-rotating parts — Part 7: Rotodynamic pumps for industrial applications, including measurements on rotating shafts |
| **ISO 14694** | Industrial fans - Specifications for balance quality and vibration levels |
| **ISO 20816-1** | Mechanical vibration — Measurement and evaluation of machine vibration — Part 1: General guidelines |
| **SAUER** | Vibration of compressors CB 05-13 |
| **WESTFALIA** | Westfalia separator mineraloil systems manual |

Legend according to vibration class

|  |  |
| --- | --- |
| Cl. A | Newly commissioned |
| Cl. B | Unrestricted |
| Cl. C | Restricted long-term operation |
| Cl. D | High probability of damage, action required |
| **Cl. D** | Vibrations over the limits but actions are not required. |

|  |  |
| --- | --- |
| In limit | Unrestricted |
| Out of limit | High probability of damage, action required |
| **Out of limit** | Vibrations over the limits but actions are not required. |

Results  
In table are presented only readings with max. RMS results for each device equipment:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Important machinery with Class D and machinery with action required.** | | | | |
| **Machine name** | **Velocity RMS (mm/s) Max** | **ISO standard** | **Bearing Envelope 0-Peak (m/s2) Max** | **Remarks and suggestions** |
| **Engine room** | | | | |
| **LO pumps** | | | | |
| Main LO pump no2 el. motor | 20.436 | **Cl. D** | 8.578 | High signal caused by insufficient stiffness. Please take measurements every month to control influence of vibrations on bearings condition. Including pump. |
| Main LO pump no2 | 1.814 | Cl. A | 7.097 |  |
| -  -    - | | | | |
| **ME HPS pumps** | | | | |
| ME HPS pump no1 el. motor | 5.535 | **Cl. D** | 54.843 | Trend should be controlled. Actions to be taken based on trend result. |
| -  -    - | | | | |
| **LT CFW pumps** | | | | |
| LT CFW pump no1 el. motor | 10.124 | **Cl. D** | 8.008 | Trend should be controlled. Actions to be taken based on trend result. Next measurement needs to be done up to week 18. Including pump. |
| LT CFW pump no1 | 1.986 | Cl. A | 8.653 |  |
| -  -    - | | | | |
| **Separators** | | | | |
| LO separator no1 el. motor | 8.787 | **Cl. D** | 70.670 | Trend should be controlled. Actions to be taken based on trend result. |
| LO separator no1 | 12.442 | Cl. D | - | Please advise if recommendation from report 4677-2022 was performed. 1. Condition of rubber feet should be checked. 2. Next measurement should be done after performing work (please send with feedback). Including el. motor. |
| -  -    - | | | | |
| LO separator no2 el. motor | 12.738 | **Cl. D** | 99.021 | Trend should be controlled. Actions to be taken based on trend result. Next measurement should be done together with separator after performing recommended maintenance jobs. |
| LO separator no2 | 23.001 | Cl. D | - | Please advise if recommendation from report 4677-2022 was performed: 1. All bolts responsible for stiffness of structure should be checked/retightened. 2. Purifier should be checked/cleaned 3. Next measurement should be done after performing work (please send with feedback). Including el. motor. |
| -  -    - | | | | |
| HFO separator no1 el. motor | 4.161 | Cl. C | 24.480 |  |
| HFO separator no1 | 6.777 | **Cl. D** | - | Trend should be controlled. Actions to be taken based on trend result. Next measurement needs to be done up to week 18. Including el. motor. |
| -  -    - | | | | |
| HFO separator no2 el. motor | - | - | - |  |
| HFO separator no2 | 10.115 | **Cl. D** | - | Trend should be controlled. Actions to be taken based on trend result. Next measurement needs to be done up to week 18. Including el. motor. Please always measure full set - motor and purifier. |
| -  -    - | | | | |
| **Framo pumps** | | | | |
| Framo pump no3 | 12.370 | **Cl. D** | 55.906 | High signal comes from flow pulsation. Trend should be controlled. Actions to be taken based on trend result. Next measurement including engine should be done during next cargo operation. Please advise load, suction and discharge pressure during next measurement. |
| -  -    - | | | | |
| Framo pump no4 | 12.798 | **Cl. D** | 55.716 | High signal comes from flow pulsation. Trend should be controlled. Actions to be taken based on trend result.Next measurement including engine should be done during next cargo operation. Please advise load, suction and discharge pressure during next measurement. |
| -  -    - | | | | |
| **Deck Air Compressor** | | | | |
| Deck air compressor el. motor | 4.938 | **Cl. D** | 66.571 | Trend should be controlled. Actions to be taken based on trend result. |
| -  -    - | | | | |
| **Important machinery below Class D and rest of machinery with no action required.** | | | | |
| **ME HPS pumps** | | | | |
| ME HPS pump no2 el. motor | 4.125 | Cl. C | 53.059 |  |
| -  -    - | | | | |
| **AE LO priming pumps** | | | | |
| DG pre-lub pump no2 el. motor | 3.276 | Cl. C | 16.510 |  |
| -  -    - | | | | |
| DG pre-lub pump no3 el. motor | 2.120 | Cl. B | 14.422 |  |
| -  -    - | | | | |
| **Deck seal water pumps** | | | | |
| Deck seal water pump no1 el. motor | 9.093 | **Cl. D** | 136.937 | Trend should be controlled. Actions to be taken based on trend result. Next measurement needs to be done up to week 18. Including pump. |
| Deck seal water pump no1 | 5.883 | Cl. C | 63.990 |  |
| -  -    - | | | | |
| **ME jacket cool pumps** | | | | |
| ME jacket cool pump no1 el. motor | 3.100 | Cl. C | 4.820 |  |
| ME jacket cool pump no1 | 1.019 | Cl. A | 4.934 |  |
| -  -    - | | | | |
| **Composite BLR feed water pumps** | | | | |
| Feed water pump for comp. boiler no1 el. motor | 7.714 | **Cl. D** | 4.706 | Trend should be controlled. Actions to be taken based on trend result. |
| Feed water pump for comp. boiler no1 | 3.383 | Cl. B | 4.744 |  |
| -  -    - | | | | |
| **Aux BLR FO pumps** | | | | |
| FO unit pump for aux. boiler no1 el. motor | 2.133 | Cl. B | 17.952 |  |
| FO unit pump for aux. boiler no1 | 0.903 | Cl. A | 7.705 |  |
| -  -    - | | | | |
| FO unit pump for aux. boiler no2 el. motor | 2.185 | Cl. B | 5.959 |  |
| FO unit pump for aux. boiler no2 | 0.991 | Cl. A | 4.289 |  |
| -  -    - | | | | |
| **FO supply pumps** | | | | |
| FO supply pump no1 el. motor | 3.851 | Cl. C | 13.208 |  |
| FO supply pump no1 | 4.358 | Cl. C | 17.952 |  |
| -  -    - | | | | |
| FO supply pump no2 el. motor | 3.761 | Cl. C | 20.685 |  |
| FO supply pump no2 | 3.222 | Cl. C | 24.518 |  |
| -  -    - | | | | |
| **FO circulation pumps** | | | | |
| FO circulation pump no1 el. motor | 4.805 | **Cl. D** | 43.799 | High signal only in one point. Trend should be controlled. Actions to be taken based on trend result. |
| FO circulation pump no1 | 4.806 | **Cl. D** | 34.538 | Trend should be controlled. Actions to be taken based on trend result. |
| -  -    - | | | | |
| FO circulation pump no2 el. motor | 5.231 | **Cl. D** | 35.183 | High signal only in one point. Trend should be controlled. Actions to be taken based on trend result. |
| FO circulation pump no2 | 5.337 | **Cl. D** | 41.218 | Trend should be controlled. Actions to be taken based on trend result. |
| -  -    - | | | | |
| **Framo pumps** | | | | |
| Framo pump no3 diesel engine | 45.0(VSG) | Cl. C | - |  |
| -  -    - | | | | |
| Framo pump no4 diesel engine | 28.0(VSG) | Cl. B | - |  |
| -  -    - | | | | |
| **Main air compressors** | | | | |
| Main air compressor no2 el. motor | 11.669 | In limit | 76.325 |  |
| Main air compressor no2 | 17.141 | In limit | 82.587 |  |
| -  -    - | | | | |
| **Air Condition compressors** | | | | |
| Air cond. compressor no1 el. motor | 3.288 | Cl. B | 19.432 |  |
| Air cond. compressor no1 | 6.262 | Cl. B | 63.800 |  |
| -  -    - | | | | |
| Air cond. compressor no2 el. motor | 3.815 | Cl. B | 36.284 |  |
| Air cond. compressor no2 | 3.866 | Cl. B | 20.988 |  |
| -  -    - | | | | |
| **Provision compressor** | | | | |
| Provision ref. compressor no1 el. motor | 4.357 | Cl. C | 23.569 |  |
| Provision ref. compressor no1 | 3.812 | Cl. B | 30.135 |  |
| -  -    - | | | | |
| **Steering gear hydraulic unit pumps** | | | | |
| Steering gear hydraulic unit pump no1 el. motor | 2.737 | Cl. B | 20.078 |  |
| -  -    - | | | | |
| Steering gear hydraulic unit pump no2 el. motor | 3.508 | Cl. C | 50.175 |  |
| -  -    - | | | | |
| **Aux boiler FD fan** | | | | |
| Aux boiler FD fan el. motor | 5.245 | Cl. B | 32.792 |  |
| -  -    - | | | | |
| **ER ventilation fans** | | | | |
| Engine room fan no1 el. motor | 2.255 | Cl. A | 29.224 |  |
| -  -    - | | | | |
| Engine room fan no2 el. motor | 2.331 | Cl. A | 28.921 |  |
| -  -    - | | | | |
| Engine room fan no3 el. motor | 2.677 | Cl. A | 40.686 |  |
| -  -    - | | | | |
| Engine room fan no4 el. motor | 2.756 | Cl. A | 28.617 |  |
| -  -    - | | | | |
| **Sewage plant** | | | | |
| Sewage plant areation blower el. motor | 4.538 | Cl. B | 12.031 |  |
| Sewage plant areation blower | 3.903 | Cl. A | 6.642 |  |
| -  -    - | | | | |

**Measurement equipment:**

|  |  |
| --- | --- |
| Technical data | |
| Maker: | Info Marine |
| Type: | MarVib DC750 |
| Serial number: | 7506954 |
| Measuring range: | 2Hz-30kHz / RPM = 60-20000 |
| Indication error: | ± 0,5% |

Equipment is calibrated, certificate for verification - if required.

|  |  |
| --- | --- |
| **Ship type:**  Tanker | **Main dimensions:**  Length(b.p).......................................183,00 m  Breadth(B.)........................................32,00 m |
| **Sea depth:**  Least twice times greater than Vessel draught |  |
| **Measurement method:**  According to standard ISO 10816 : - procedure No. 2 Measurement report | |

Summary  
Next measurements should be done in three month period to obtain trend value for each equipment, in some cases even one month period is preferable.  
  
This report is prepared in good faith based on measurement diagnostic done on available running rotary machine and documentation submitted.

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| **Prepared by:** | **Approved by:** |
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