Understanding Vibration Measurement

Introduction to vibration measuring

Vibration measuring is a crucial aspect of engineering and industrial applications that involves the quantification and analysis of mechanical oscillations or vibrations in a system. Vibration can occur in various forms, such as linear motion, torsional motion, and rotational motion, and it is essential to measure and monitor these vibrations to ensure the proper functioning and reliability of machinery and structures.

Here's a brief introduction to vibration measuring:

Purpose of Vibration Measurement:

Monitoring Machinery Health: Vibration measurement helps in assessing the condition of machinery and equipment. Abnormal vibrations can indicate faults, misalignments, imbalance, or other issues.
Structural Health Monitoring: In civil engineering, measuring vibrations in structures like bridges and buildings is essential to ensure their stability and safety.

Basic Concepts:

Amplitude: The extent of the vibration, usually measured in units like millimeters or micrometers.
Frequency: The rate at which the vibration occurs, measured in Hertz (Hz).
Phase: The relative position of one vibration cycle to another, providing information on the synchronization or time lag between different vibrations.

Instruments for Vibration Measurement:

Accelerometers: These devices measure acceleration and are widely used for detecting and monitoring vibrations. They convert mechanical motion into an electrical signal that can be analyzed.
Velocity Sensors: Measure the rate of change of displacement with respect to time. Velocity sensors are suitable for identifying higher frequency vibrations.
Displacement Sensors: Directly measure the displacement of an object during vibration. They are useful for low-frequency vibrations.

Data Analysis and Signal Processing:

Fast Fourier Transform (FFT): Used to convert time-domain data into frequency-domain data, providing a clearer understanding of the vibration spectrum.
Vibration Analysis Software: Specialized software helps engineers analyze and interpret vibration data, identifying patterns and potential issues.

Applications:

Machine Health Monitoring: Vibration measurement is crucial in predictive maintenance, allowing early detection of machinery issues and preventing costly breakdowns.
Automotive Engineering: Used for assessing vehicle dynamics, comfort, and safety.

Structural Health Monitoring: Applied in civil engineering to monitor the health and integrity of bridges, buildings, and other structures.

Standards and Guidelines:

Organizations like the International Organization for Standardization (ISO) provide standards for vibration measurement and analysis, ensuring consistency and accuracy in the field.
In conclusion, vibration measuring is a vital tool for engineers and technicians to maintain the reliability and efficiency of machinery and structures, ensuring safe and optimal operation in various industrial and engineering applications.

Petrik Naval Capabilities

1. Measured values 1. Bearing noise (BDU) The bearing noise (high frequency vibration) is shown in Bearing Damage Units (BDU), where 100 BDU corresponds to 1g RMS (average) vibration measured above 1 kHz. BDU is a measure of the wear state of the bearings in the equipment being monitored. The higher the number, the more worn the bearing. 1g of high frequency vibration (100 BDU) corresponds to a high level of bearing noise and can be considered indicative of a damaged bearing. Think of bearing noise as being roughly equivalent to percentage of bearing wear.

2. Total acceleration (g). This is the RMS value of the total vibration acceleration measured by the meter over its entire frequency range (2 Hz to 10 kHz). This reading is shown in units g (Earth's gravitational constant, where 1g = 9.81 m/s2.

3. ISO values (mm/s) RMS The ISO value (mm/s or inch/s) is the large number which is the RMS (average) of the vibration velocity in the frequency band 10 Hz to 1 kHz (600 – 60,000 RPM) or 2 Hz – 1 kHz (120 – 60,000 RPM), as specified by ISO standards. The correct frequency band is automatically selected based on running speed. ISO 10816 Standard

4. ISO values (mm/s) um PK The ISO value (mm/s or inch/s) is the large number which is the RMS (average) of the vibration velocity in the frequency band 10 Hz to 1 kHz (600 – 60,000 RPM) or 2 Hz – 1 kHz (120 – 60,000 RPM), as specified by ISO standards. The correct frequency band is automatically selected based on running speed. ISO 10816-1 Standard.

5. Measuring instrument

    a. Measuring instrument identification
        i. Make: Amphenol Wilcoxon Model: MAC800 SN: 2109M0013
    b. Measuring instrument capabilities
        i. ISO 10 Hz - 1 kHz (600 - 60,000 CPM) ISO Low Speed 2 Hz - 1 kHz (120 - 60,000 CPM) BDU 1 Hz - 10 kHz (60 - 600,000 CPM) Sensor Type 780FM-2-J88C integral cable accelerometer Sensitivity 100 mV/g Sensitivity tolerance ± 15% Acceleration range 80 g Frequency range, ±3 dB 0.4 Hz to 12 kHz Acceleration limit 500 g.

6. ISO 10816 consists of the following Parts, under the general title Mechanical Vibration - Evaluation of machine Vibration by measurements on non-rotating Parts: Part 1 General guidelines Part 2 Large land based steam turbine generator sets in excess of 50MW Part 3 Industrial machines with nominal power

above 15kW and nominal speed between 120 RPM and 15000 RPM when measured in situ Part 4 Gas turbine driven sets excluding aircraft derivatives Part 5 Machine sets in hydraulic power generating and pumping plants

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			C				C	7,1
D								4,5
			B				B	3,5
C			A				A	2,8
								2,3
B								1,4
A								0,7
Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	mm/s RMS
Pumps Radial, Axial or Mixed Flow P > 15kW				Med Size Machinery 15kW < P < 300kW		Large Machinery P > 300kW		Machine Type
Integrated Drive		External Drive		Motors 160mm< H < 315mm		Motors 315mm < H		
Group 4		Group 3		Group 2		Group 1		Group
A New Machinery Condition		B Unlimited long term operation allowable		C Short term operation allowable		D Vibration causes damage		Condition