5.2 An Introduction To Vibration Measurement

Vibration is a reliable indicator of the mechanical health or condition of a particular machine or product. An ideal machine will have very little or no vibration indicating that the motor, as well as peripheral devices such as gearboxes, fans, compressors, etc., are suitably balanced, aligned, and well installed.

In practice, a very high percentage of installations are far from ideal, the results of misalignment and imbalance exerting added strain on supporting components such as bearings. Eventually this leads to added stress and wear on critical components, resulting in inefficiency, heat generation and breakdowns. This often occurs at the most inconvenient or uneconomical times, causing costly production downtime. As parts of mechanical equipment wear and deteriorate, the equipment vibration increases.

Monitoring the vibration of healthy mechanical equipment on an ongoing basis, detects any deterioration long before it becomes a critical problem, allowing spares to be ordered in advance and maintenance to be planned only when necessary. In this way stocks of expensive and unnecessary spares can be reduced with obvious financial benefits.

Unscheduled breakdowns result in production losses and the faulty equipment is usually repaired hastily to get production going as quickly as possible. Under these stressful conditions, staff are not always able to do repairs correctly regardless of how conscientious they are, resulting in a high probability of further equipment failure.

By implementing a predictive maintenance program with regular measurements of critical factors like vibration, downtime can not only be reduced, but planned maintenance is more effective, resulting in improved product quality and greater productivity.

5.3 What is a Trend?

A trend is an indication of the way in which a monitored vibration parameter behaves over time. If regular vibration typically mil or mm equivalent peak-peak.

Limit of rank ‘N’ is suitable for common motor. When the request is higher than that in the table, limit can be gotten by dividing the limit of rank ‘S’ with 1.6 or multiples of 1.6.

C. Maximum vibration of motor that power larger than 1 horsepower (NEMA MG1-12.05)

<table>
<thead>
<tr>
<th>Quantity rank</th>
<th>Rev (rpm)</th>
<th>Maximum vibration velocity (rms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal (N)</td>
<td>999</td>
<td>0.71</td>
</tr>
<tr>
<td>Good (G)</td>
<td>1000-1999</td>
<td>0.71</td>
</tr>
<tr>
<td>Excellent (E)</td>
<td>2000-3600</td>
<td>1.12</td>
</tr>
</tbody>
</table>

* For AC motor, rev is maximum synchronous rev. For DC motor, it is maximum power rev. For motor in series, it is work rev.

D. Maximum vibration of high power induction drive motor (NEMA MG1-20.52)

<table>
<thead>
<tr>
<th>Rev (rpm)</th>
<th>Displacement (P-P) (um)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2250-4450</td>
<td>25.4</td>
</tr>
<tr>
<td>1000-2249</td>
<td>29.2</td>
</tr>
<tr>
<td>1000-1499</td>
<td>67.6</td>
</tr>
<tr>
<td>≥ 599</td>
<td>74.2</td>
</tr>
</tbody>
</table>

National Electric Manufacturers Association (NEMA)
Establishes two standards above.

Digital Vibration Meter

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Displacement : 0.001-4.000mm
0.04-160.0 mil, equivalent pk-pk
RPM (r/min) : 60-99,990 r/min
Readings should be multiplied by 10
if the display show '10'.
Frequency: 1-20 kHz
Frequency range for measuring
Acceleration : 10Hz. to 1kHz. In '1' mode
10Hz. to 10kHz. In '10' mode for bearing condition check
Velocity : 10Hz. to 1kHz.
Displacement : 10Hz. to 1kHz.
Accuracy: 5%±2 digits
Metric/ Imperial conversion
PC interface: RS232C
Output: AC output 2.0V peak full scale
(load resistance: above 10k)
Power supply: 4x1.5 AAA size (UM-4) batteries
Power off : 2 modes
Manual off at any time or Autopower off after 5 minutes from last key operation
Operating conditions:
Temperature: 0-50 °C
Humidity : below 90% RH
Dimensions: 124x62x30mm/4.9x2.4x1.2 inch
Weight: 120g (not including batteries)

Accessories included:
Powerful rare earth magnet...............1 pc.
Accelerometer..............................1 pc.
Stinger probe (Conc) ......................1 pc.
Stinger probe (Ball) ......................1 pc.
Carrying case .............................1 pc.
Operation manual........................1 pc.
Optional accessories:
Headphones for use as electronic stethoscope
Cable and software for RS232C
1. FEATURES
* In accordance with ISO 2954, used for periodic measurements, to detect out-of-balance, misalignment and other mechanical faults in rotating machines.
* specially designed for easy on site vibration measurement of all rotating machinery for quality control, commissioning, and predictive maintenance purposes.
* Individual high quality accelerometer for accurate and repeatable measurements
* Bearing condition monitoring function
* LCD digital display
* Lightweight and easy to use
* Wide frequency range (10Hz. To 10kHz.) in acceleration mode
* Automatic power off to conserve power.
* Optional headphones for use as electronic stethoscope.
* Can communicate with PC computer for statistics and printing by the optional cable and the software for RS232C interface.

2. SPECIFICATIONS
Display: 4 digits, 18mm LCD
Measured values and makers
(units, 10, and battery symbol)
Transducer: Piezoelectric accelerometer
Parameters measured:
Velocity, Acceleration, and Displacement
RPM and Frequency

Velocity
Velocity : 0.01-40.00 cm/s true RMS
Measuring range:
0.000-16.00 inch/s

Acceleration
Acceleration : 0.1-400.0 m/s² equivalent peak
0.000-160.0 inch/s

3. FRONT PANEL DESCRIPTIONS

4. MEASURING PROCEDURE
4.1 Connect the Accelerometer to the input connector and turn it until the connector locks in position.
4.2 Mount the accelerometer at the measurement point using the powerful magnet supplied, ensuring that the mounting surface is clean and flat, or use direct stud (MS) mounting if this is available.
4.3 Depress the power key and release to power on the meter.
4.4 Each time the Function key is pressed and released quickly, the meter will step to the next vibration measurement parameter with the corresponding unit showing on the display.

5. CONSIDERATIONS
5.1 Which Parameters Should be Measured?
Acceleration, velocity, and displacement are the three tried and tested parameters, which give accurate and repeatable results.

Acceleration is normally measured in m/s² peak (meters per second squared) or ft/s², has excellent high-frequency measurement capabilities, and is therefore very effective for determining faults in bearings or gearboxes.

Velocity is the most commonly used vibration parameter. It is used for vibration severity measurement in accordance with ISO 2372, BS 4675 or VDI 2056, which are guidelines for acceptable vibration levels of machinery in different power categories. These are presented as a table in section 4 of this manual.

Velocity is typically measured in cm/s or inch/s RMS (centimeters or millimeters per second). Note: This instrument measures in cm/s. If you are more familiar with measurements in mm/s, or wish to compare your measured values directly with the vibration severity chart in section 4, multiply the displayed value by 10.

Displacement is typically used on low-speed machines because of its good low frequency response, and is relatively ineffective when monitoring bearings. Units are