

Vibration Pen^{plus}

CMVP40 (in/s) eq. Peak
CMVP50 (mm/s) RMS



Overall Vibration and Acceleration Enveloping



Overview

A Multi-Parameter approach to condition monitoring provides two different methods for monitoring machinery condition. This allows for early detection of specific machinery problems and provides more ways to measure changes in machinery condition.

The Vibration Pen^{plus} is a Multi-Parameter vibration monitoring tool capable of measuring vibration (caused by rotational and structural problems like imbalance, misalignment, looseness, etc.), and capable of measuring vibration in higher frequencies (caused by rolling element bearing or gearmesh problems).

Multi-Parameter Monitoring is the most thorough and effective method for monitoring bearing and machinery condition. The Vibration Pen^{plus} tool's Multi-Parameter approach provides accurate and reliable data upon which to base maintenance decisions and promotes

early detection, confirmation, and accurate trending of bearing and machinery problems.

Functional Description

When performing measurements, the Vibration Pen^{plus} tool's sensor input signal is processed to produce two different measurements for each machinery POINT, Overall Vibration and Acceleration Enveloping.

The Vibration Pen^{plus} tool's LCD simultaneously displays both measurement values. Depending on the type and location of the machinery component being measured, either or both readings may be of interest.

Overall Vibration

(ISO 2954/DIN 45666 Standard)
Low Frequency Vibration
(10 Hz to 1 kHz)

Overall velocity vibration occurring in the 10 Hz to 1 kHz frequency band is considered the best operating parameter for judging rotational and structural problems like imbalance, resonance, misalignment, looseness, and stress applied to components.

Many machinery problems may

cause excessive overall vibration. Mechanical looseness, imbalance, soft foundation, misalignment, rotor bow, resonance, eccentricity, bad belts, or lost rotor vanes can all be measured with overall ISO vibration measurements.

Measuring the overall vibration of a machine or component, or the structure of a machine, and comparing the measured value to the machine's normal value (or to ISO 2372/VDI 2056 standards) indicates machinery health and condition changes.

- Overall vibration is not an indicator of bearing or gearmesh problems that typically occur in higher frequency ranges.

Acceleration Enveloping

Bearing/Gearmesh Frequency Vibration (10 kHz to 30 kHz)

Acceleration Enveloping measurements measure the high frequency repetitive vibration signals typically caused by bearing and gearmesh problems.

ISO (International Organization for Standardization)



CMVP40/CMVP50 Vibration Pen ^{plus}

Envelope detection is very useful in rolling element bearing and gearmesh analysis where a low amplitude, repetitive vibration signal may be hidden by the machine's rotational and structural vibration noise.

For example, suppose a rolling element bearing has a defect on its outer raceway. Each rolling element strikes the defect as it passes the defect, causing a small, repetitive vibration signal. This vibration signal is of such low amplitude that, under normal ISO vibration monitoring, it is lost in the machine's other rotational and structural noise.

Envelope detection filters out low frequency rotational signals, then enhances the high frequency defect signals to focus on repetitive events in the 10 kHz to 30 kHz frequency range, and provides an averaged peak value for early detection of bearing and gearmesh problems.

- Acceleration enveloping measurements do not detect rotational or structural vibration caused by imbalance, misalignment, looseness, etc.

Easy Operation

Vibration Pen ^{plus} readings are easily performed, simply:

- Turn the Vibration Pen ^{plus} on.
- Press the Vibration Pen ^{plus} tool's sensor tip against your machinery measurement POINT.
- Wait for the readings to stabilize, and record the measurement values.

Easy Evaluation

The Vibration Pen ^{plus} tool's front-panel LCD simultaneously shows overall velocity vibration readings in mm/s RMS (CMVP50) or in in/s eq. Peak (CMVP40), and acceleration enveloping readings in g^E ("E" indicating Enveloped acceleration).

The SKF Vibration Pen ^{plus} severity card provides quick reference for ISO Standard 2372 overall velocity vibration comparisons.

Machinery class designations are:

Class I – Individual parts of engines and machines, integrally connected with the complete machine in its normal operating condition. (Production electrical motors of up to 15 kW are typical examples of machines in this category.)

Class II – Medium-sized machines (typically, electric motors with 15 to 75 kW output) without special foundations, rigidly mounted engines, or machines on special foundations (up to 300 kW).

Class III – Large prime movers and other large machines with rotating masses mounted on rigid and heavy foundations which are relatively stiff in the direction of vibration measurement.

Class IV – Large prime movers and other large machines with rotating masses mounted on foundations which are relatively soft in the direction of vibration measurement (for example, turbo-generator sets, especially those with light weight substructures).

Vibration Severity		Velocity Range Limits and Machinery Classes ISO Standard 2372			
CMVP40 in/s eq. Peak	CMVP50 mm/s RMS	Small Machines	Medium Machines	Large Machines	
		Class I	Class II	Rigid Supports Class III	Flexible Supports Class IV
0.02	0.28		Good		
0.03	0.45				
0.04	0.71				
0.06	1.12		Satisfactory		
0.10	1.80				
0.16	2.80		Unsatisfactory		
0.25	4.50				
0.39	7.10				
0.62	11.20		Unacceptable		
1.00	18.00				
1.56	28.00				
2.50	45.00				
3.95	71.00				

Support classification according to ISO 2372

Flexible Support: The fundamental natural frequency of the machine/support system is lower than its main excitation frequency.

Rigid Support: The fundamental natural frequency of the machine/support system is higher than its main excitation frequency.

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