Variations in Vibration Measurements

When using different SKF portable devices

Overview

Although SKF takes great care of conformity when comparing measurements from one device to another, there will be always slight differences.Some of the reasons are related to the particular devices. Other explanations involve the question of how the measurements were obtained. There are four axioms to consider when comparing measurements:

- At the same location
- At the same time
- Using the same sensor
- Utilizing the same mounting technique.

At the same location

The measurement location should be flat and free of paint or rust. It may help to mark the spot. A different result can be obtained when moving the sensor just a little. The excitation may be dissimilar in different locations due to the sensor's position to the origin of the vibration.

At the same time

It is very difficult to measure at the same time when comparing measurements with different devices without compromising on the location. Machine vibrations can vary in a very short time duration.

Using the same sensor

All accelerometers are subject to their specifications in regard to temperature, frequency response, etc. Even sensors from the same series have known tolerances and can differ from each other within their tolerances.

Utilizing the same mounting techniques

The difference in mounting technique is the most understated reason for obtaining different measurement results. The more steady and rigid the sensor connection to the measurement surface is, the longer the frequency response remains flat (same relative sensitivity). The flatness is needed for accurate amplitude measurement results in higher frequencies.

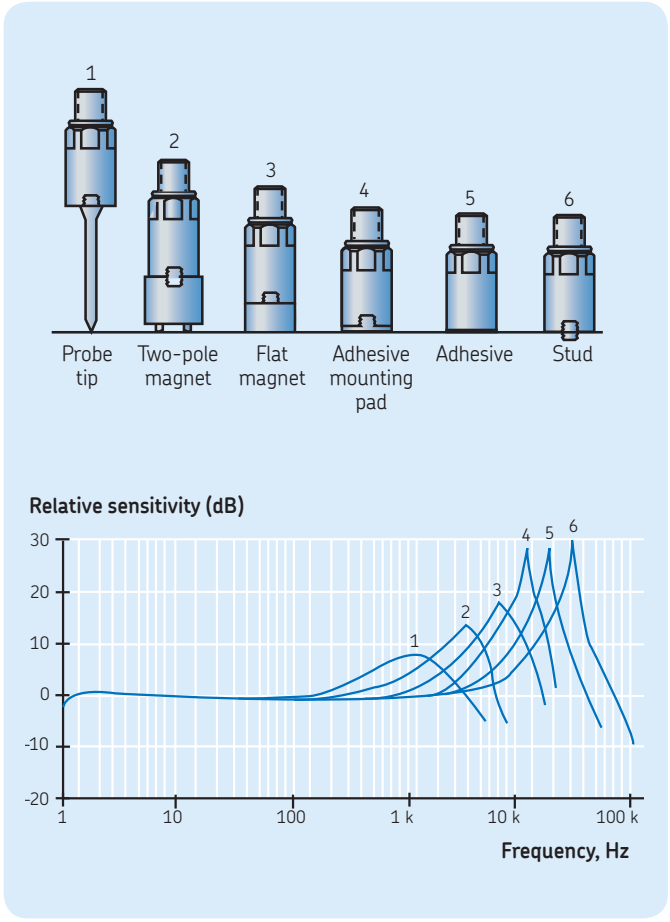

Figure 1. Approximation of frequency curves with different mounting techniques.

Velocity measurements

Velocity measurements often conform to the International Organization for Standardization (ISO), in the recommended filterband from 10 to 1 000 Hz. The detection type specified is RMS (root means square), as opposed to true peak detection.

SKF portables measure velocity in Metric (mm/s) or in Imperial (in./s), whereas the latter is derived from the RMS values and sometimes called pseudo or equivalent peak. In the case of the SKF Microlog Analyzer, the RMS value is derived from the calculated spectrum. Only measurements taken with the same detection type and taken in the same filterbands can be compared.

Enveloped acceleration measurements

The enveloped acceleration technique is not covered by an international standard; it is an SKF developed method and cannot be compared to other demodulation performances. The selected enveloped acceleration filter settings must be equal when comparing measurements between SKF instruments.

The SKF Machine Condition Advisor (MCA) in enveloped acceleration measurements is using a similar filterband as the SKF Microlog filterband #3, from 500 Hz to 10 kHz. The Vibration Pen^{Plus} (CMVP 40 / CMVP 50) is using a filterband from 10 to 30 kHz; as a result, enveloped acceleration overall values are not comparable.

The instruments for machine problem indication, like the SKF Machine Condition Detector (MCD, CMVL 3600-IS) and the SKF Machine Condition Advisor (MCA, CMAS 100-SL), cannot change the filtering and gain settings, therefore the SKF Microlog must be configured to match the two instruments.

Enveloped acceleration reading may vary depending on the defect signal as well as the mounting method. It is imperative to use the same mounting method.

The following setup table is designed to match the SKF Microlog readings as closely as possible to the SKF Machine Condition Detector (MCD) and the SKF Machine Condition Advisor (MCA) readings.

Table 1

Setup table

SKF Microlog settings	Velocity	Enveloped acceleration
System Setup		
FFT:	Hz	Hz
FFT:	Linear	Linear
System:	Metric or English	N/A
Auto Range:	On	On
User Mode:	Analysis	Analysis
Data Storage:	Normal	Normal
Sensor Mode:	Normal	Normal
Connector:	Multipin/BNC	Multipin/BNC
Setting:	Aggressive	Aggressive
Analyzer Input Setup		
Type:	Acc to Vel	ENV ACC
Filter:	N/A	500 Hz to 10 kHz
Detection:	RMS/Peak	Peak to Peak
Input:	100 mV/EU	100 mV/EU
Low Freq Cutoff:	10 Hz	10 Hz
Analyzer Spectrum		
Lines:	400	200 to 400
Start Freq:	0	0
# of Averages:	5	5
Type:	Average	Average
Mode:	Continuous	Continuous
FMAX:	1 000 Hz	1 000 Hz / 15 000 Hz

Note: Setting the SKF Microlog Fmax frequency to 1 000 Hz (in some cases, use 1.5 kHz) is a fair approximation to the difference in anti-aliasing and different low pass filters of the SKF Machine Condition Detector (MCD) and the SKF Machine Condition Advisor (MCA).

Additional tips

In general, avoid greasy, oily, wet or painted surfaces, housing splits and structural gaps. If possible, hold the sensor tip against a clean, flat surface in the bearing's load zone and press perpendicular to the surface (90°) with even, consistent and firm hand pressure. Enveloped acceleration readings are especially influenced by varying the pressure.

Early tests with the SKF Machine Condition Advisor and the SKF Microlog have shown that the best results were achieved when using the same sensor (external) and the same mounting technique (stud mounted or magnet). The optional connection cable CMAC 107 makes it possible to connect any standard 100 mV/g ICP (Integrated Circuit Piezoelectric) accelerometer to the Advisor unit.

Summary

The question of how much difference is too much is not easily answerable. For example, for velocity measurements, the ISO norm used to calibrate the instrument allows a ±10% tolerance for signals in between 200 and 500 Hz, is absolute accurate at 80 Hz and widens the tolerance around the filter frequencies (10 Hz and 1.0 kHz). A machine signal will have components at many different frequencies. Furthermore, data analyzers are adjustable (e.g., Fmax) to the machine signal and the SKF Machine Condition Advisor and SKF Machine Condition Detector are compromised to serve detection of typical machine signals.

The SKF Machine Condition Advisor is a machine condition and bearing degradation indicator. However, when comparing the measurements to other more sophisticated SKF equipment like data analyzers (SKF Micrologs), good results can be obtained when following the considerations outlined before.

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