Benefits of Implementing a Basic Vibration Analysis Program for Power Transmission Drives

Condition monitoring

Vibration analysis is a powerful tool that when integrated into an overall inspection program will help save maintenance costs by;

1. Reducing the risk of unexpected downtime
2. Extremely effective safeguard against total loss
3. Timely ordering of replacement parts to reduce expediting costs
4. Advance planning shortens repair and inspection times

Some of the specific types of vibration causing problems that can be detected in the analysis:

1. Bearing defects or wear
2. Damaged or worn teeth
3. Misalignment; internal or external
4. Rotating looseness or imbalance
5. Resonance, loose components
6. Bending or eccentricity
7. Unequal thermal effects
8. Bad belt drives

A proper vibration analysis program will include the following;

1. Natural forcing frequencies from the shaft speeds, gear mesh frequencies and bearing frequencies shall first be determined
2. A record of operational parameters will be established which shall include such items as the lubricating oil temperature, load, history of work done, etc.
3. The initial visit will establish the baseline criteria
4. Readings are taken at designated points
5. Results will determine the source of vibration
6. Subsequent visits are compared to the baseline such that statistical alarm and warning limits maybe established
7. Each set of measurements are analyzed for frequency, phase, and amplitude

Periodic vibration monitoring reports/findings and recommendations:

We recommend annual, or biannual reporting visits under normal loaded conditions for trending data and to establish a measurement program utilizing proven baseline values from the ISO standards. With this method meaningful spectral alarm bands can be generated. Statistical limits may then be created consistently against developing trends. The findings can be objectively evaluated and compared against the historical data.

ISO 10816 Vibration Severity Chart (see page 3)

ISO 10816 was released in August 2000, establishes the general conditions and procedures for measurement and evaluation of vibrations using measurements made on the non-rotating parts of machines. It also provides general evaluation criteria related to both operational monitoring and acceptance testing established primarily with regard to securing reliable long term operation of the machine.

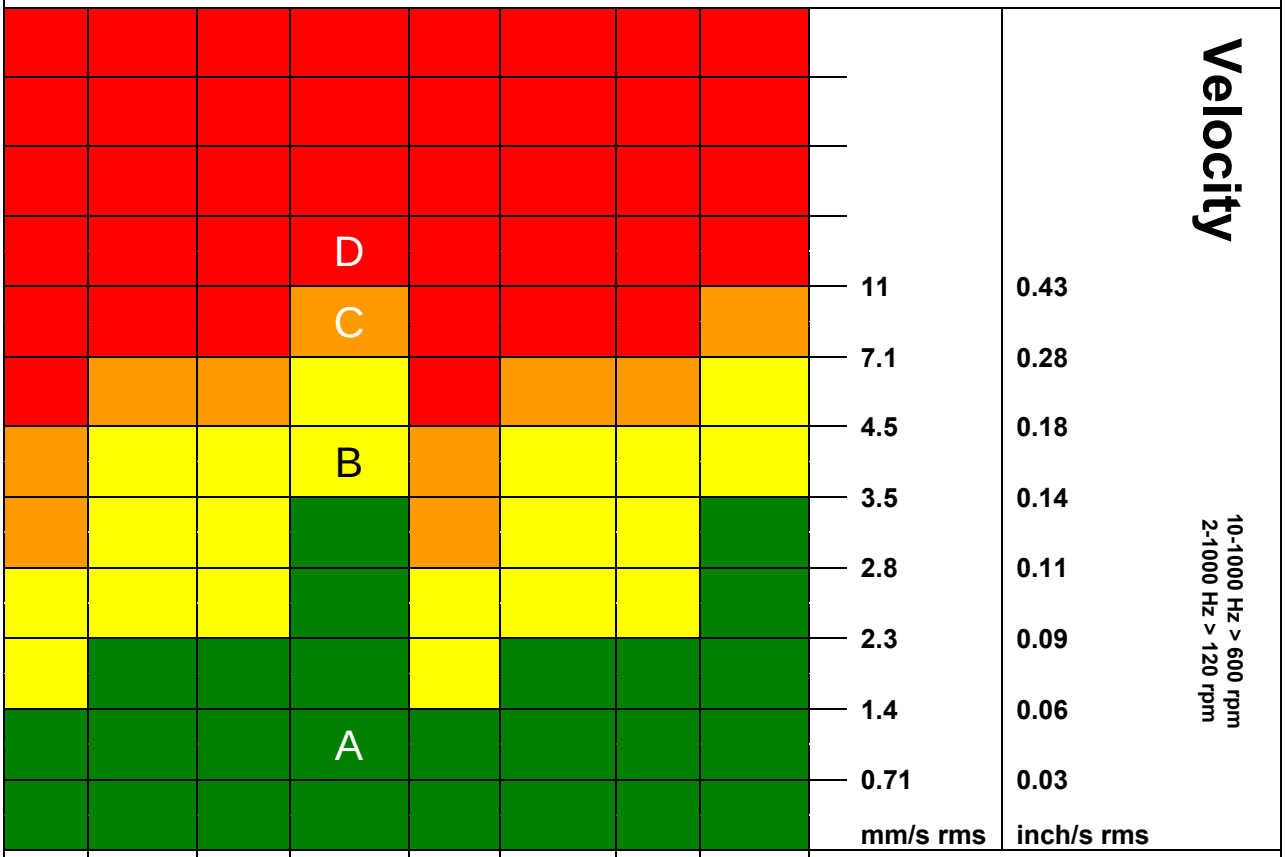
ISO 10816-3 separates the working conditions into four zones:

- **Zone A Green:** Vibration values from machines just put into operation.
- **Zone B Yellow:** continuous operation without any restrictions.
- **Zone C Orange:** condition is acceptable only for a limited period of time.
- **Zone D Red:** Dangerous vibration values - damage could occur at any time.

It also defines four groups of machines, according to their size, base and purpose.

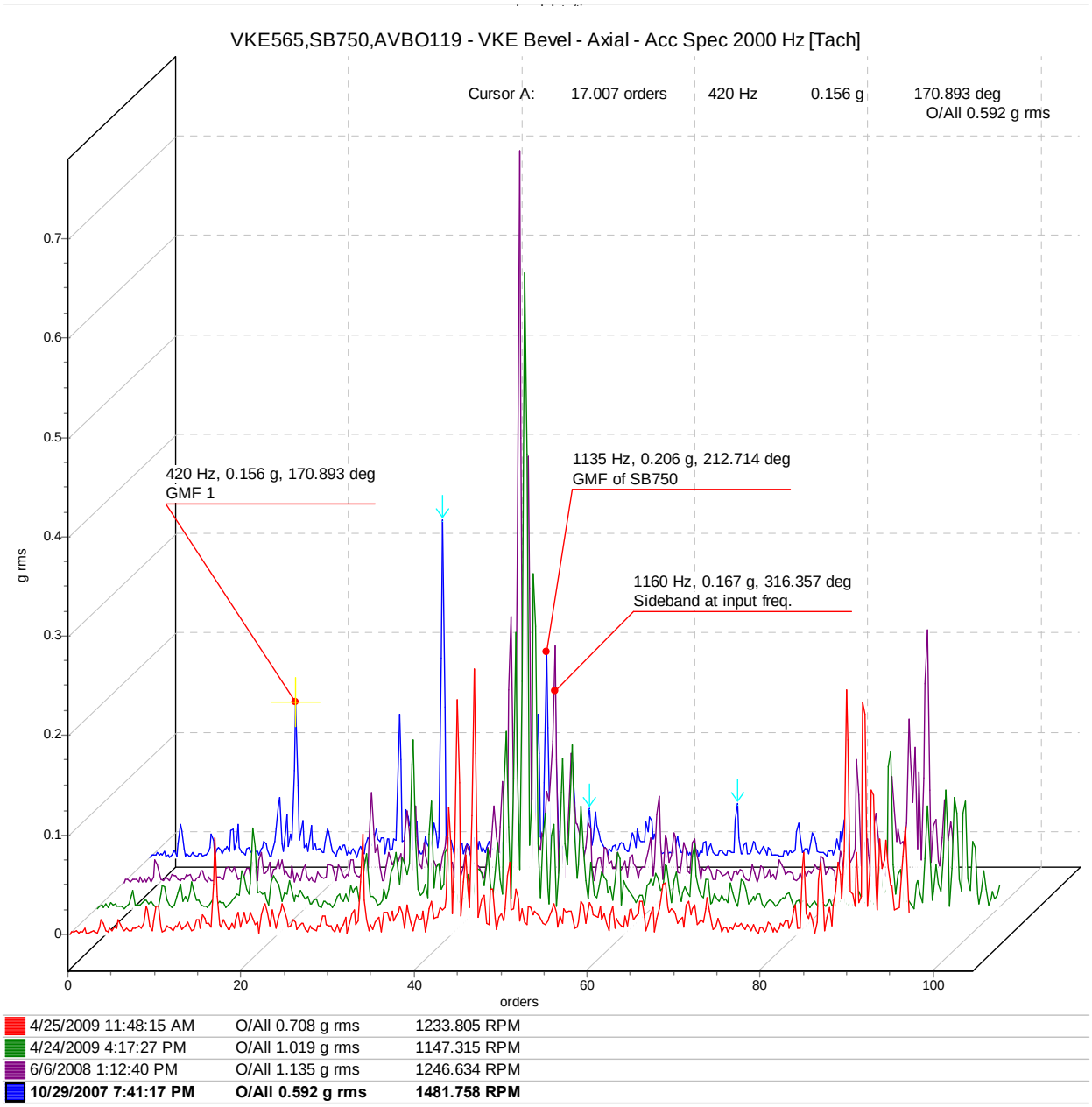
Ref: Vibration Severity Chart

ISO 10816-3 Vibration Severity Chart



Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Rigid	Flexible	Foundation
pumps > 15 kW radial, axial, mixed flow				medium sized machines 15kW <P<300kW		large machines 300kW <P< 50MW		Machine Type
integrated driver		external driver		motors 160 mm ≤ H ≤ 315 mm		motors 315 mm ≤ H		
Group 4		Group 3		Group 2		Group 1		Group

	A	New machine condition		C	Short-term operation allowable
	B	Unlimited long-term operation allowable		D	Vibration causes damage



The above figure is a trending example of a waterfall plot of vibration readings over a two year period.

An example for permanently mounted sensors would apply for remote access or internal mounting. The following equipment is an example to monitor overall gear vibration:

Low frequency 500 mV/g accelerometers mounted externally or internally can be output to a portable analyzer unit for trend analysis. The accelerometers can be mounted internally or on remote external locations

The accelerometers will be mounted on mounting pads which can be epoxy mounted (or drilled and tapped) to the bearing housing. The accelerometer would screw mount to this pad.

The R6GSLI-0-J9T3-SS-armored cable has a wired braided outer jacket, an IP66 connector at the accelerometer end and blunt cut on the other end. It's a very rugged cable suitable for this application.

The cables from the accelerometers can go into the CB4 box mounted externally for safe and easy remote access to measurements.

Radially Mounted Sensor

Axially Mounted Sensor

Sensor Terminal Box