Certification Exam Reference Material

$$T = T_s \times N = \frac{N}{F_S} = \frac{N}{2.56 \times F_{max}} = \frac{lines}{F_{max}}$$

T = Tempo necessario per acquisire la forma d’onda

Ts = Tempo intercorrente tra 2 campioni (samples)

Fs = Frequenza di campionamento= Campioni per secondo

N = Numero di campioni (1024, 2048, 4096, etc.)

$$Risoluzione = \frac{F_{max}}{linee}$$

$$Ampiezza\ di\ banda = Risoluzione \times Window\ factor$$

Window factor = 1 (no window/uniforme/rettangolare) o 1.5 (Hanning window)

Frequenza di separazione ≥ 2 x Ampiezza di banda ≥ 2 x Risoluzione * Window Factor

Linee di spettro necessarie ≥ 2 x Window factor x Fmax / Frequenza di separazione

Accuratezza frequenza (al picco) = ± ½ x Resoluzione

Numeri primi: 1, 2, 3, 5, 7, 11, 13, 17, 19…

1 pollice = 25.4 mm
1mm = 0.039 pollici

Calcolo peso di prova:

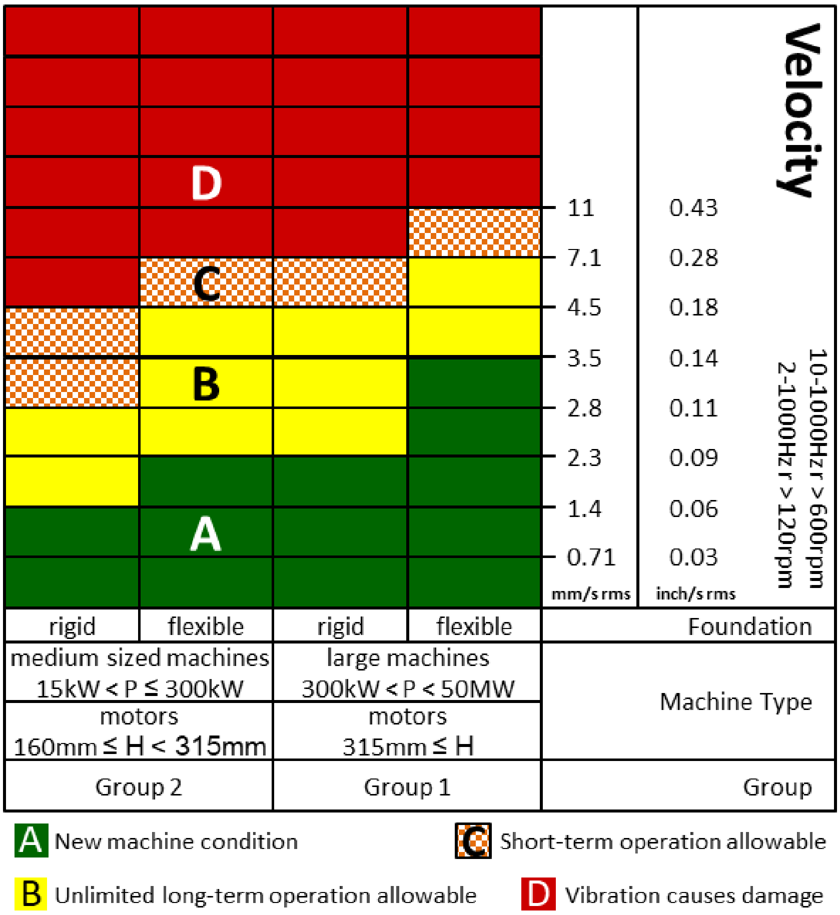
$$W = \frac{F}{K \times R \times N^2}$$

F = 10% della massa del rotore diviso per il numero di cuscinetti (in kg)
K = 0.011
N = RPM/1000
R = Raggio in cm

Unit Conversions

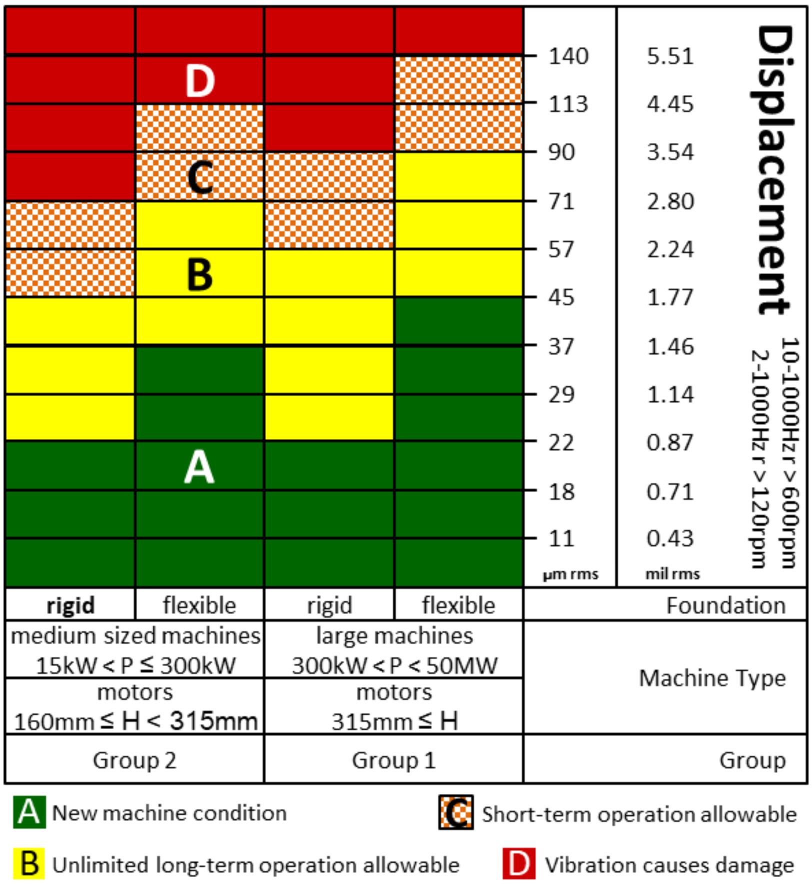
Imperial	Metric
$D_{pk-pk} = \frac{19098\ V_{pk}}{f_{cpm}}$ $\quad V_{pk} = \frac{5217\ A_{rms}}{f_{cpm}}$	$D_{pk-pk} = \frac{27009\ V_{rms}}{f_{cpm}}$ $\quad V_{rms} = \frac{93712\ A_{rms}}{f_{cpm}}$
$D_{pk-pk} = \frac{9.958x10^7 A_{rms}}{f_{cpm}^2}$ $\quad A_{rms} = \frac{f_{cpm} V_{pk}}{5217}$	$D_{pk-pk} = \frac{2.53x10^9 A_{rms}}{f_{cpm}^2}$ $\quad A_{rms} = \frac{f_{cpm} V_{rms}}{93712}$
$V_{pk} = \frac{f_{cpm} D_{pk-pk}}{19098}$ $\quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{9.958x10^7}$	$V_{rms} = \frac{f_{cpm} D_{pk-pk}}{27009}$ $\quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{2.53x10^9}$
D = Displacement: mils pk-pk **V = Velocity:** in/sec pk **A = Acceleration:** g rms **F = Frequency:** CPM	**D = Displacement:** micron pk-pk **V = Velocity:** mm/sec rms **A = Acceleration:** g rms **F = Frequency:** CPM **1g rms = 9.8m/sec²**

ISO 10816-3 Vibration Severity Chart

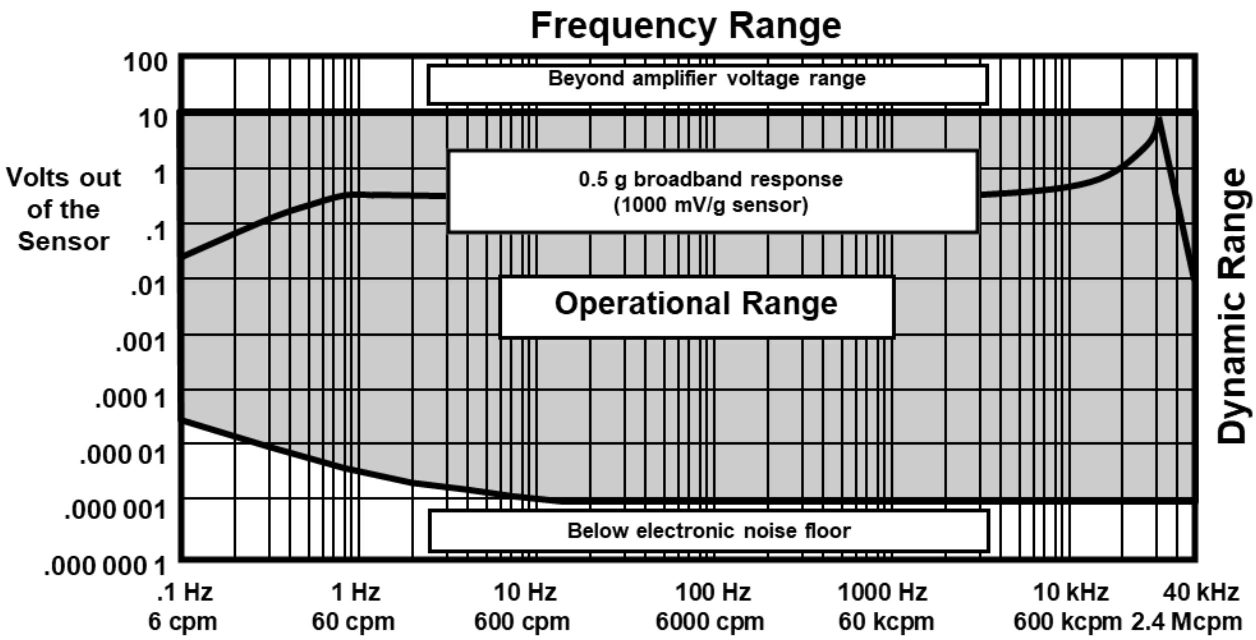


If the lowest natural frequency of the combined machine and support system in the direction of measurement is higher than its main excitation frequency (this is in most cases the rotational frequency) by at least 25 %, then the support system may be considered rigid in that direction. All other support systems may be considered flexible.

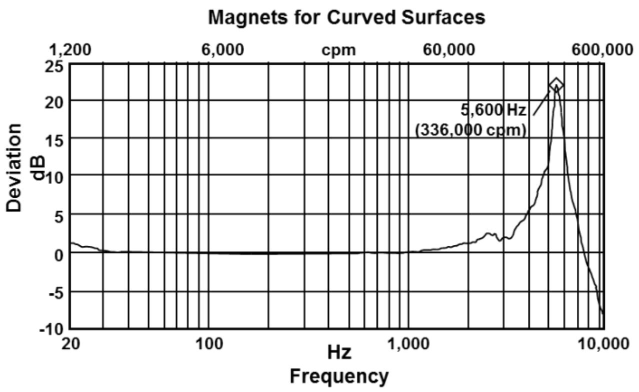
ISO 10816-3 Vibration Severity Chart



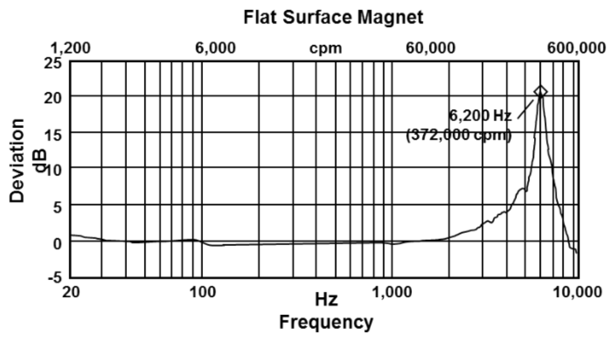
Transducer Operating Regions



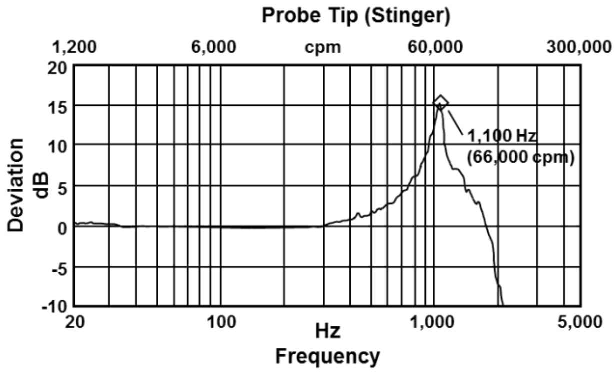
Transducer Frequency Response - Magnets on Curved Surfaces



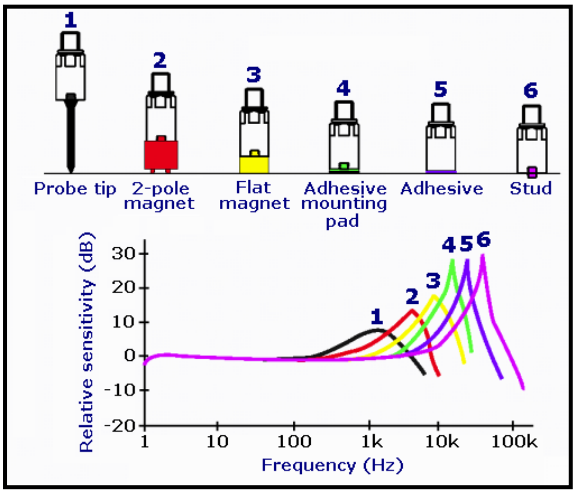
Transducer Frequency Response - Magnets on Flat Surfaces



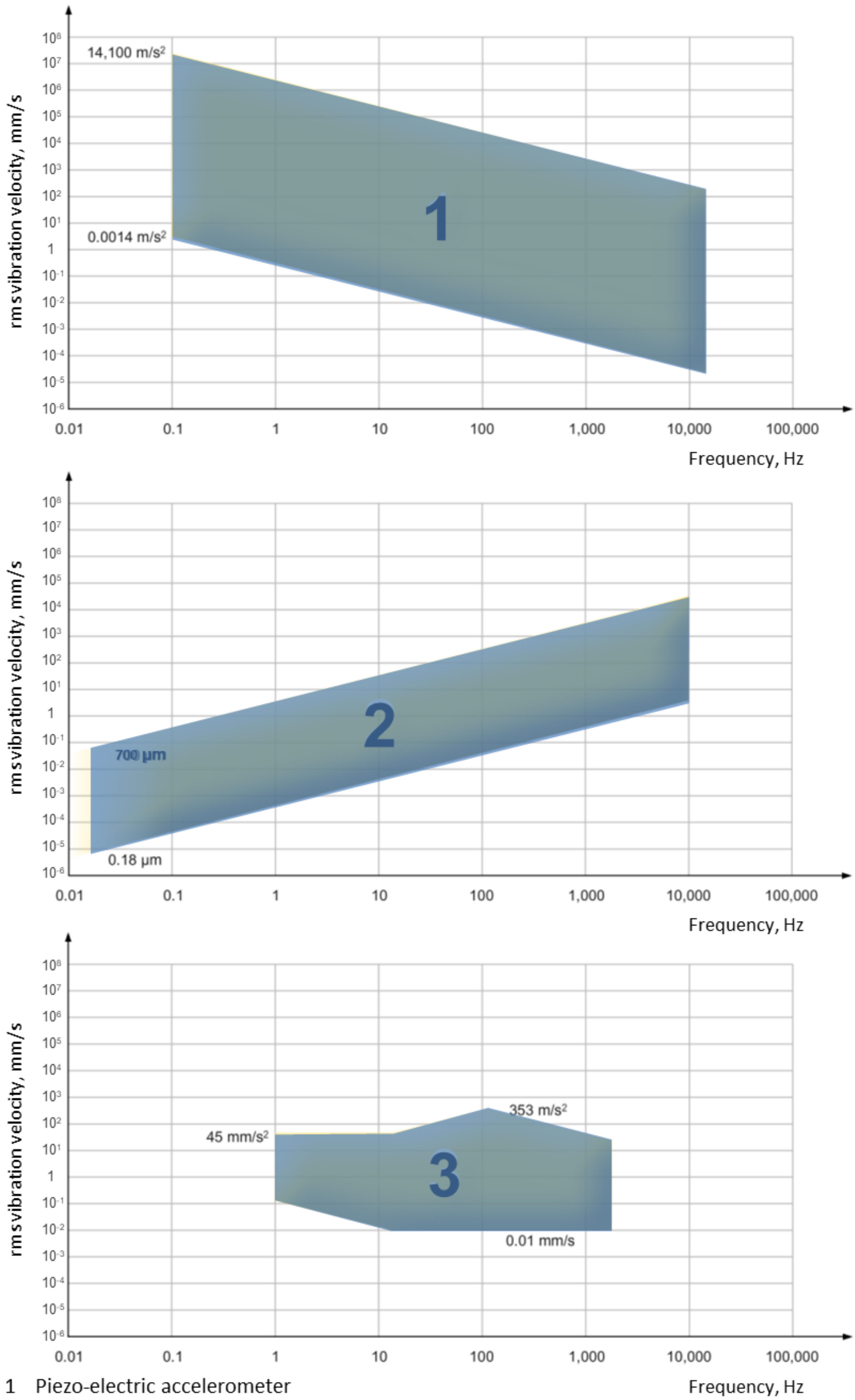
Transducer Frequency Response - Stingers or Hand Held Probes



Transducer Frequency Response Curves

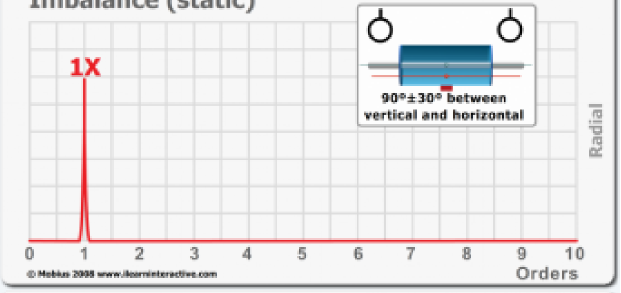


Transducer Effectiveness Regions

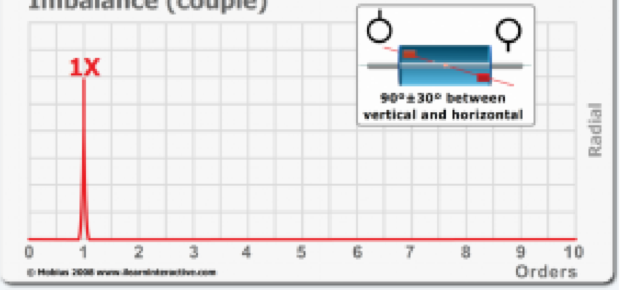


1 Piezo-electric accelerometer
2 Eddy-current proximity probe
3 Electro-mechanical velocity transducer

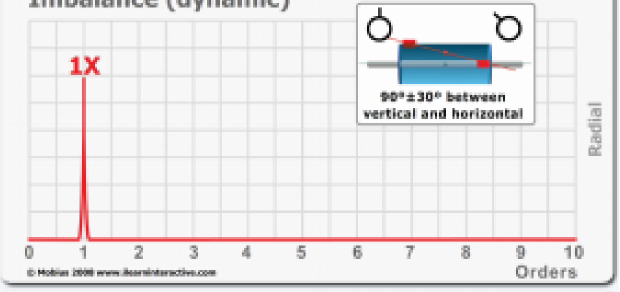
Imbalance (static)



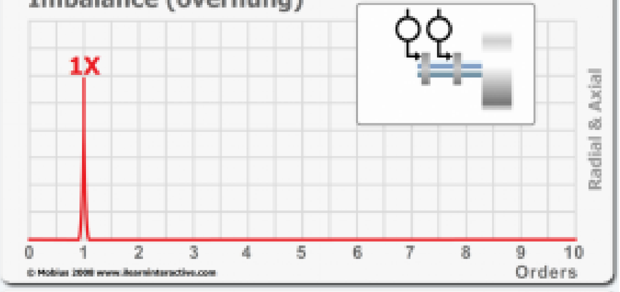
Imbalance (couple)



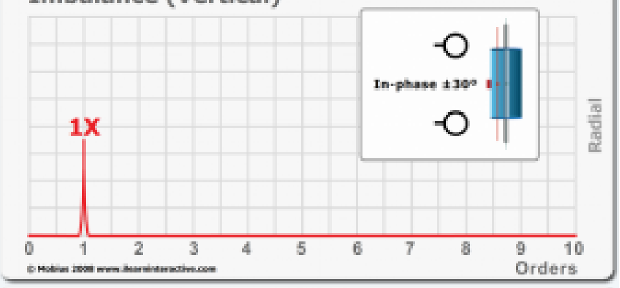
Imbalance (dynamic)



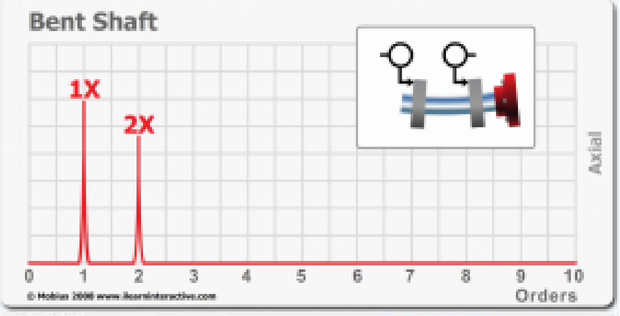
Imbalance (overhung)



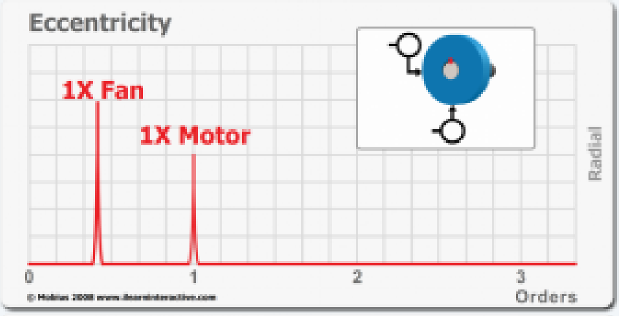
Imbalance (Vertical)



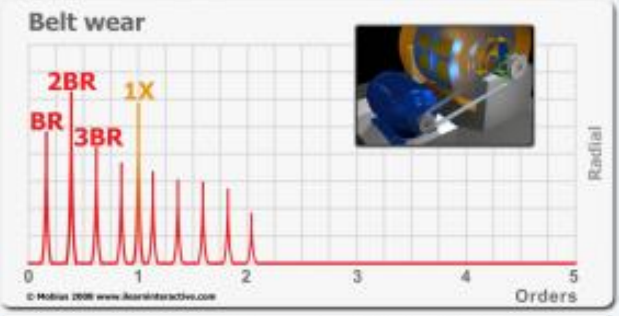
Bent Shaft



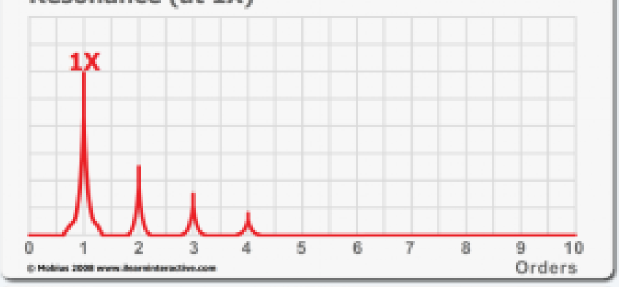
Eccentricity



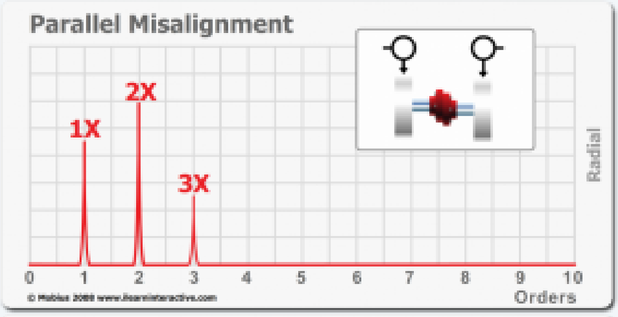
Belt wear



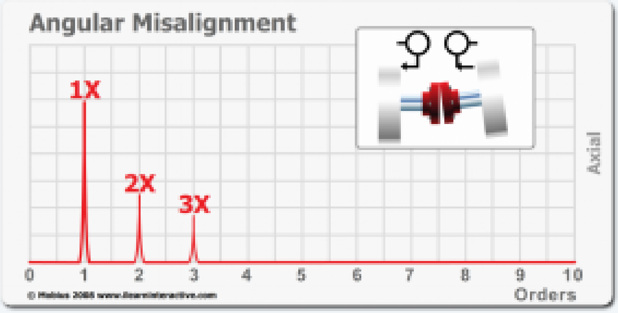
Resonance (at 1X)



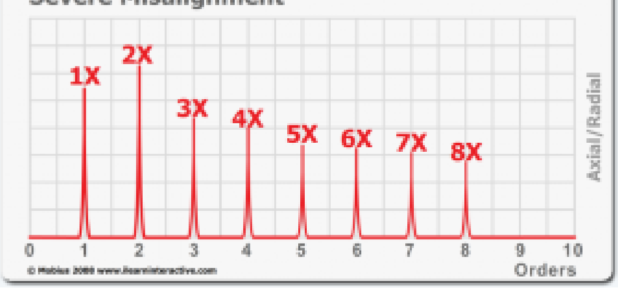
Parallel Misalignment



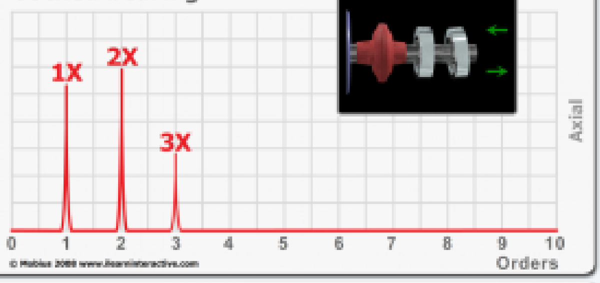
Angular Misalignment



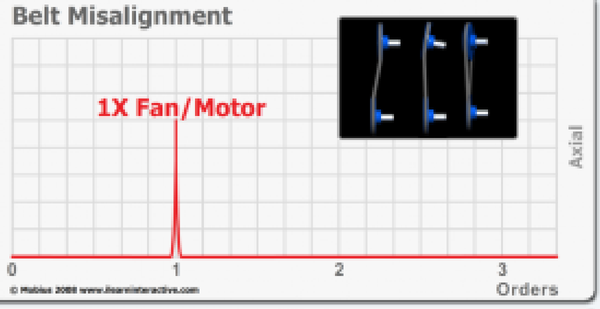
Severe Misalignment



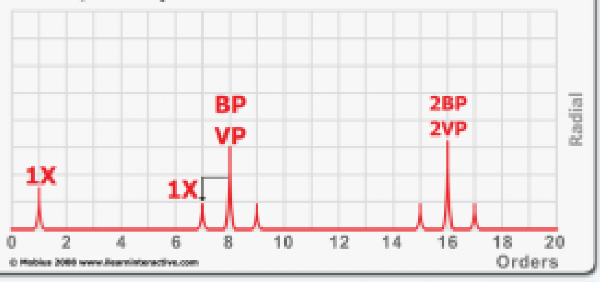
Cocked bearing



Belt Misalignment

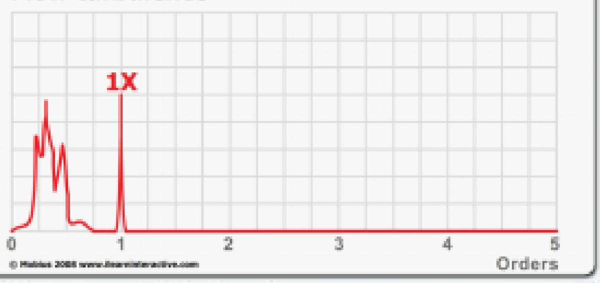


Blade/vane pass

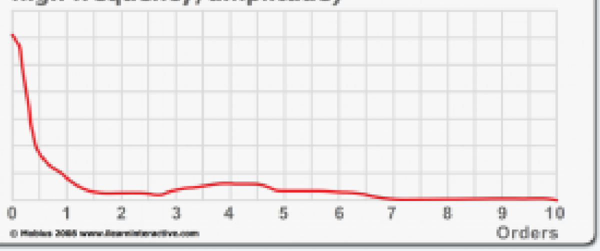


Cavitation

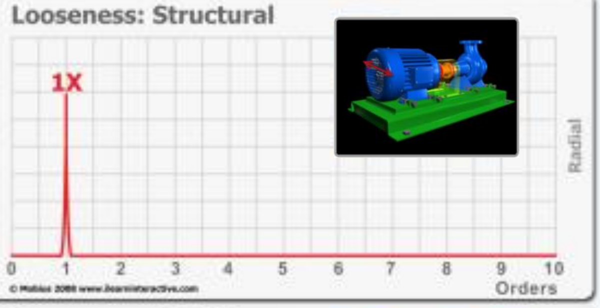
Flow turbulence



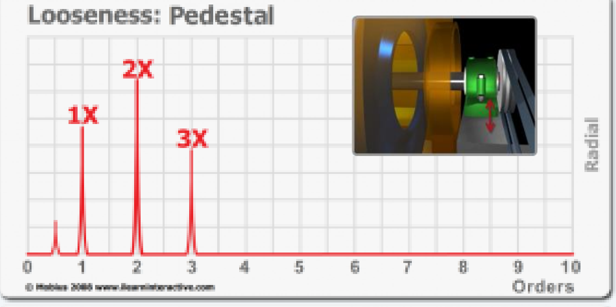
Ski slope (bad measurement or very high frequency/amplitude)



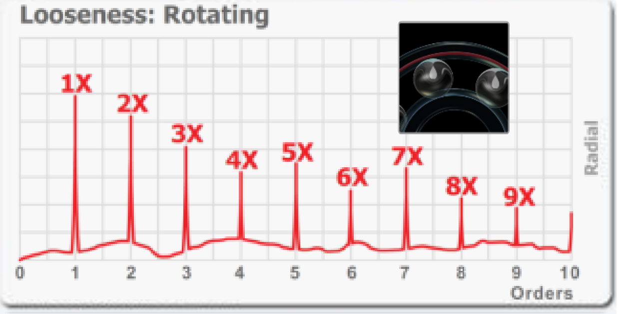
Looseness: Structural



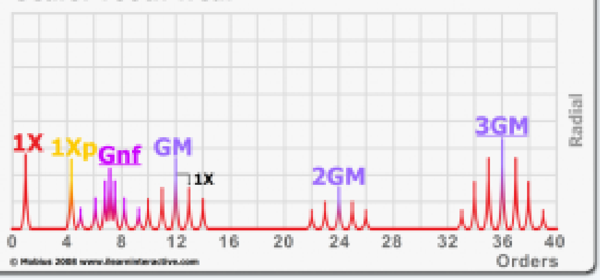
Looseness: Pedestal



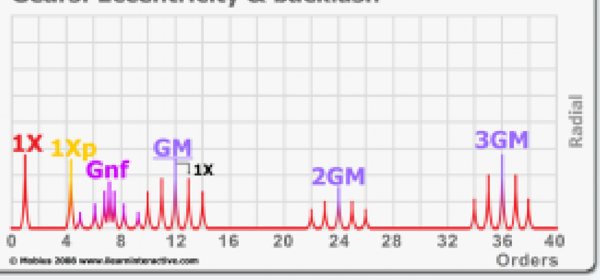
Looseness: Rotating



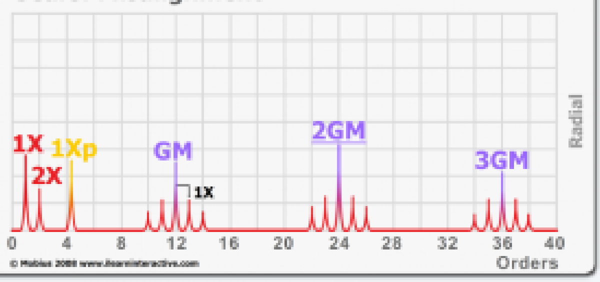
Gears: Tooth wear



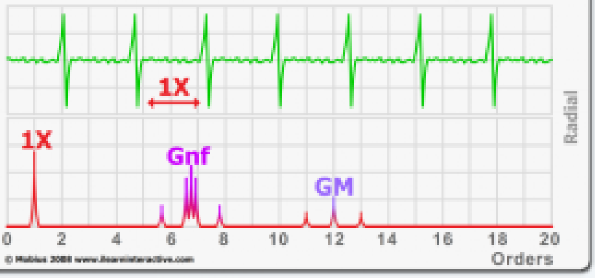
Gears: Eccentricity & backlash



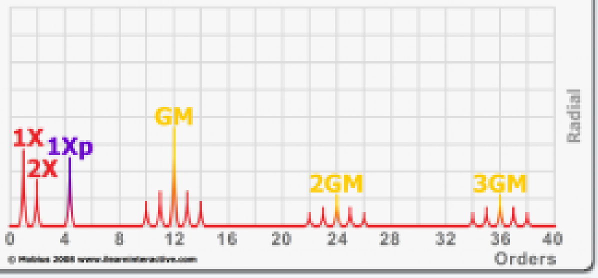
Gears: Misalignment



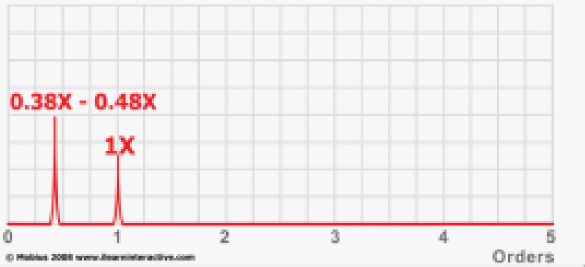
Gears: Cracked or broken tooth



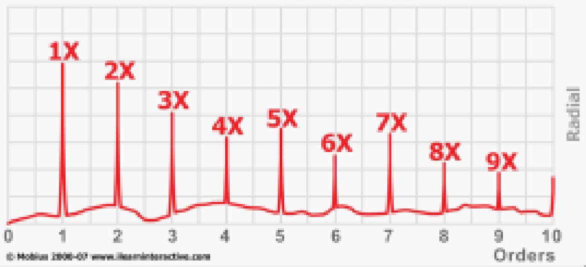
Gears: Tooth Load



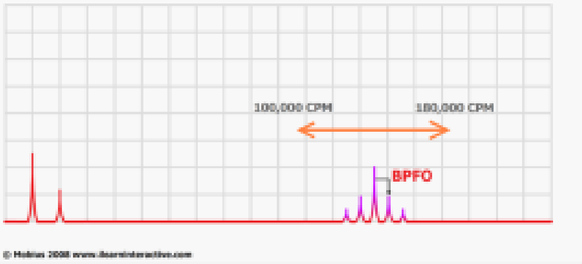
Journal bearing oil whirl



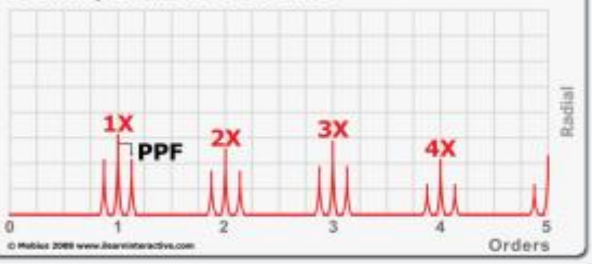
Journal Bearing Looseness



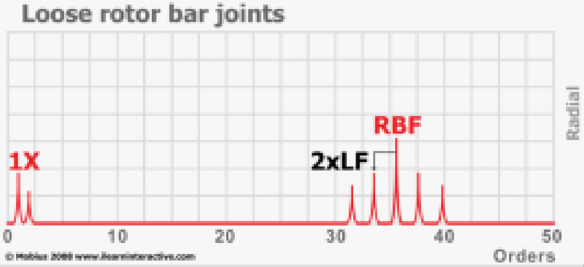
Bearings: Fluting



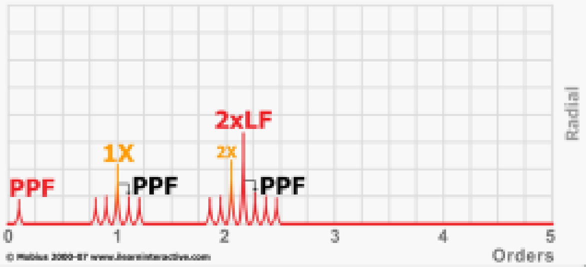
Broken/cracked rotor bars



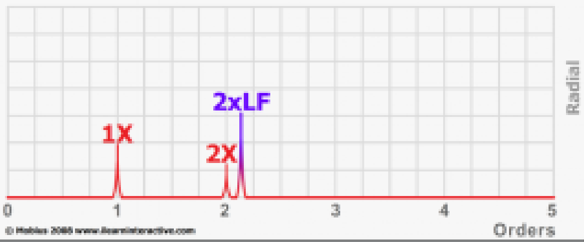
Broken/cracked rotor bars
Loose rotor bar joints



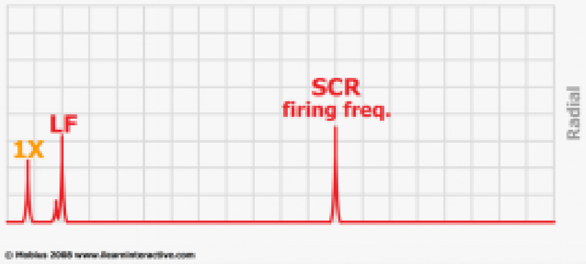
Eccentric rotor



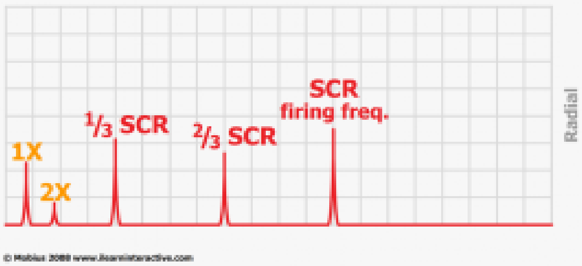
Stator Eccentricity, Loose Iron, Shorted Laminations or Soft foot



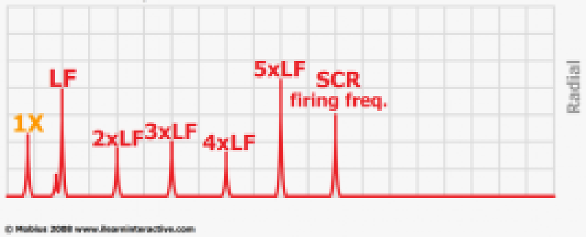
Grounding fault or turning fault

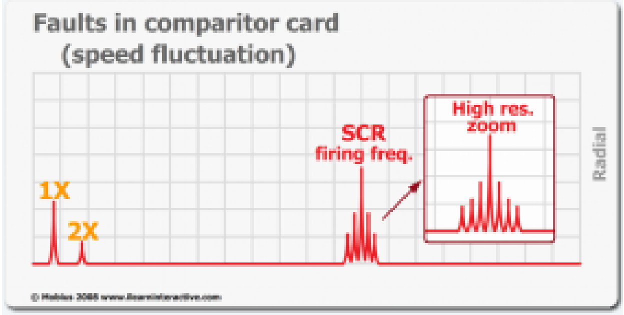


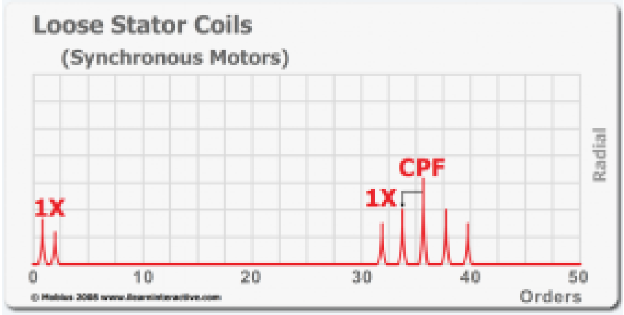
Phase loss

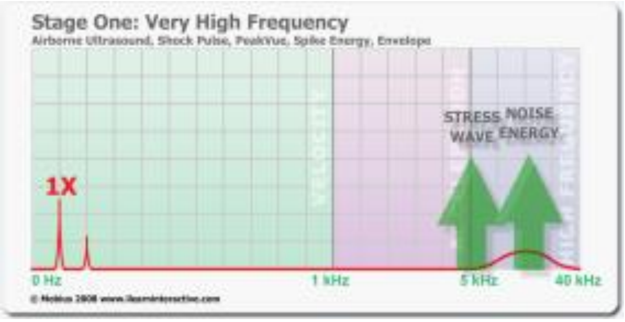


Shorts in control card, loose connector, and more.

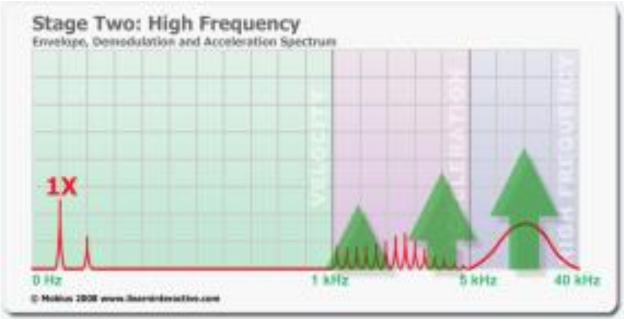




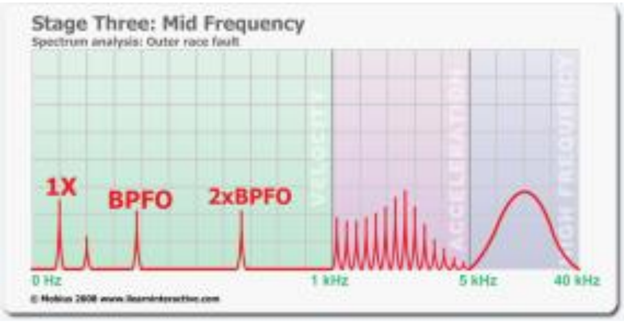




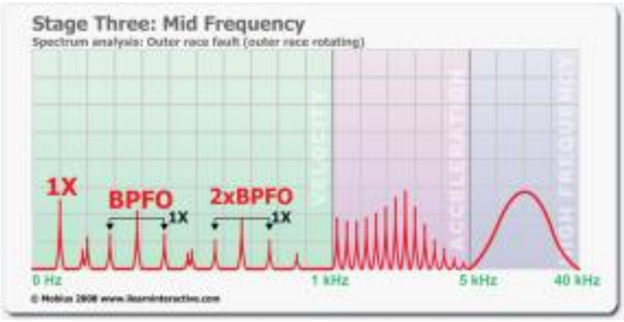
Stage One: Airborne Ultrasound, Shock Pulse, PeakVue, Spike Energy, Envelope



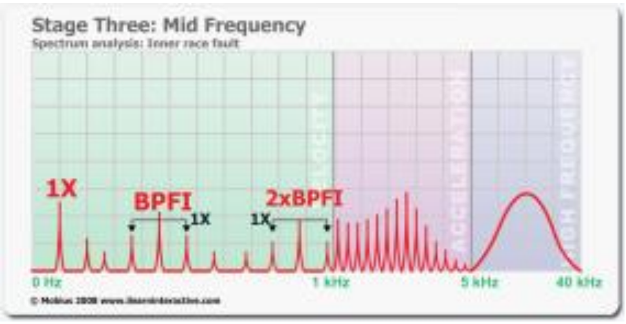
Stage Two: Envelope, Demodulation and Acceleration Spectrum



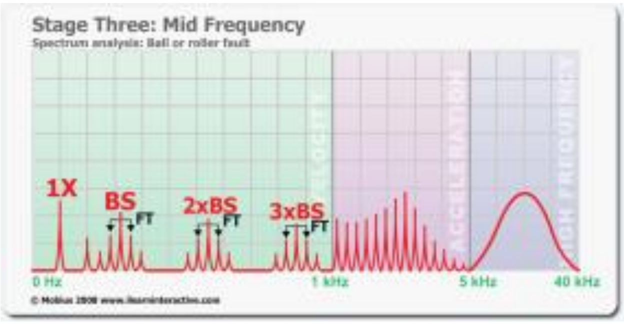
Stage Three: Outer race fault (inner race rotating)



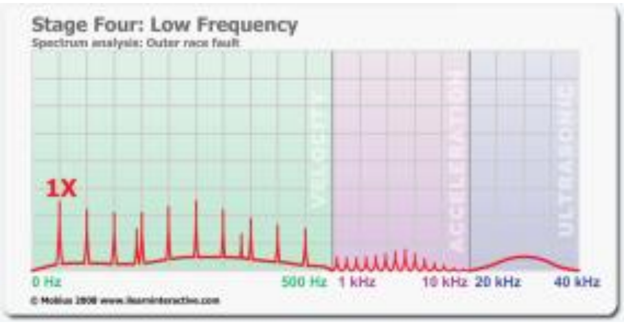
Stage Three: Outer race fault (outer race rotating)



Stage Three: Inner race fault (inner race rotating)



Stage Three: Ball or roller fault (inner race rotating)



Stage Four

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