

BAHAN REFERENSI UJIAN SERTIFIKASI

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

T = Waktu yang dibutuhkan untuk pengambilan data waveform

T_s = Waktu antara tiap sampel data

F_s = Laju sample data = Jumlah data per detik

N = Jumlah data sample (1024, 2048, 4096, etc.)

$$\text{Resolusi} = \frac{F_{max}}{\text{lines}}$$

$$\text{Bandwidth} = \text{Resolusi} \times \text{Window factor}$$

Window factor = 1 (no window/uniform/rectangular) or 1.5 (Hanning window)

Frekuensi pemisah (*separating freq.*) ≥ 2 x Bandwidth ≥ 2 x Resolusi * Window Factor

Jumlah lines yang diperlukan di spectrum ≥ 2 x Window factor x Fmax / Frekuensi pemisah

Keakuratan frekuensi (di Peak) = ± ½ x Resolution

Bilangan Prima: 1, 2, 3, 5, 7, 11, 13, 17, 19...

1 inch = 25.4 mm

1mm = 0.039 inches

Perhitungan Berat Trial:

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

F = 10% dari berat rotor dibagi dengan jumlah bearing (kg)

K = 0.011

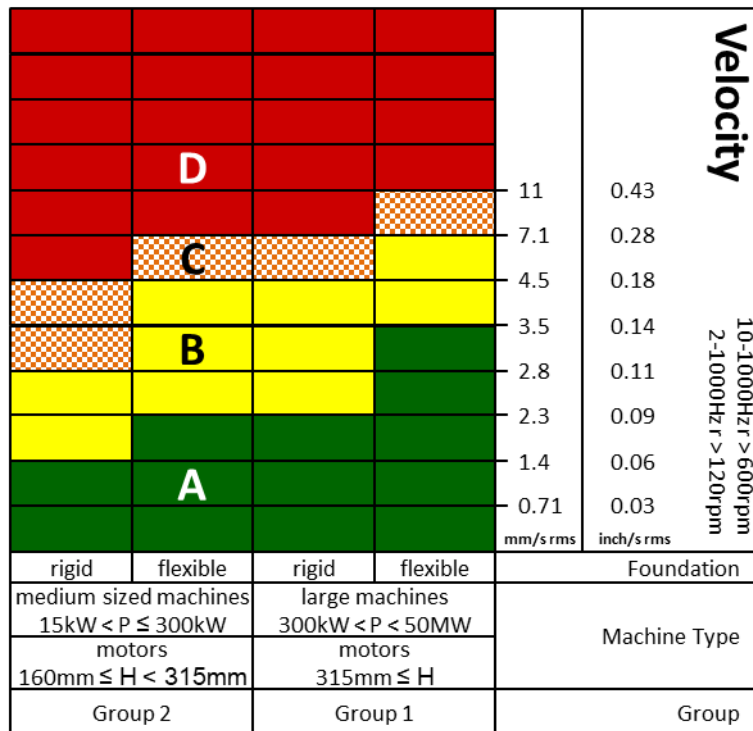
N = RPM/1000

R = Radius dalam cm

Konversi satuan

$D_{pk-pk} = \frac{19098 V_{pk}}{f_{cpm}} \quad V_{pk} = \frac{5217 A_{rms}}{f_{cpm}}$	$D_{pk-pk} = \frac{27009 V_{rms}}{f_{cpm}} \quad V_{rms} = \frac{93712 A_{rms}}{f_{cpm}}$
$D_{pk-pk} = \frac{9.958 \times 10^7 A_{rms}}{f_{cpm}^2} \quad A_{rms} = \frac{f_{cpm} V_{pk}}{5217}$	$D_{pk-pk} = \frac{2.53 \times 10^9 A_{rms}}{f_{cpm}^2} \quad A_{rms} = \frac{f_{cpm} V_{rms}}{93712}$
$V_{pk} = \frac{f_{cpm} D_{pk-pk}}{19098} \quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{9.958 \times 10^7}$	$V_{rms} = \frac{f_{cpm} D_{pk-pk}}{27009} \quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{2.53 \times 10^9}$
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

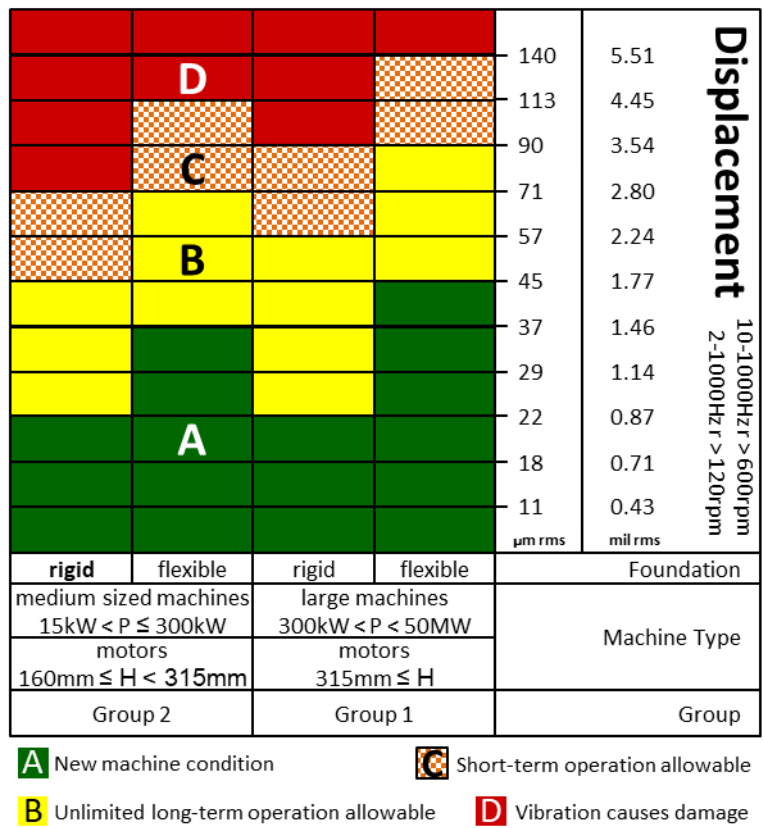
ISO 10816-3 Vibration Severity Chart



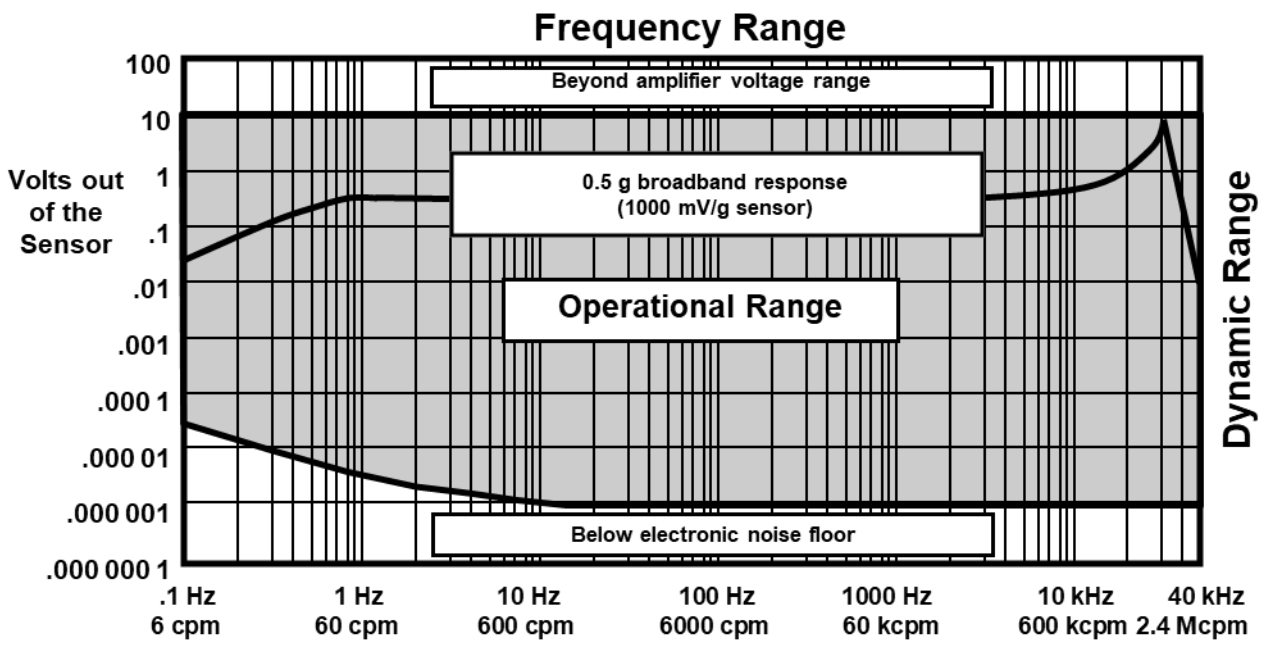
- A New machine condition
- B Unlimited long-term operation allowable
- C Short-term operation allowable
- D Vibration causes damage

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.

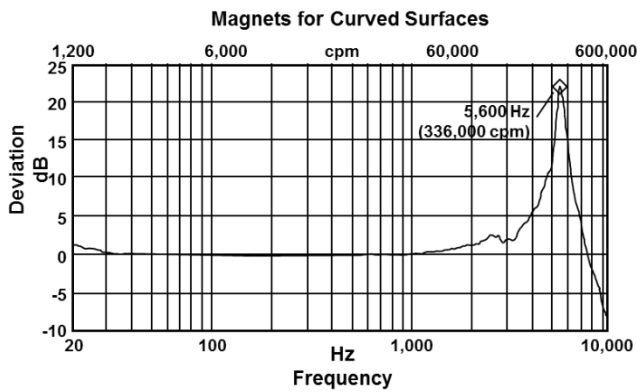
ISO 10816-3 Vibration Severity Chart



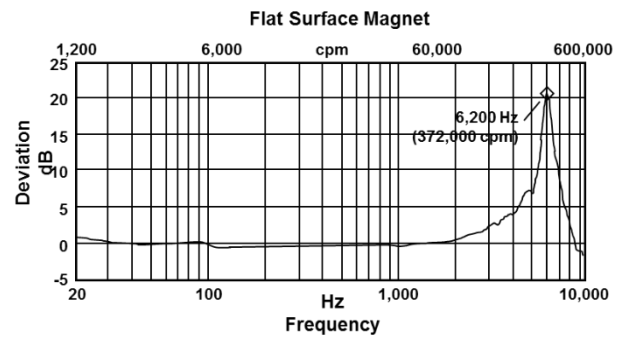
Transducer Operating Regions



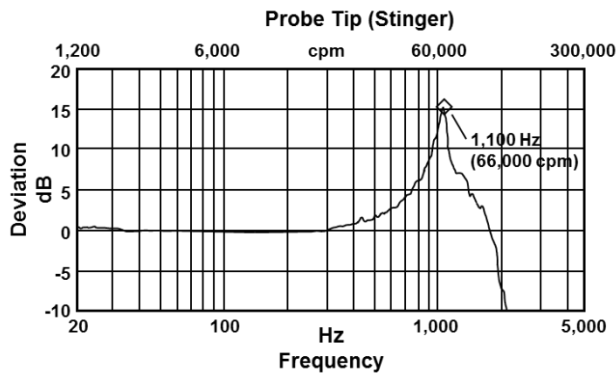
Transducer Frequency Response - Magnets on Curved Surfaces



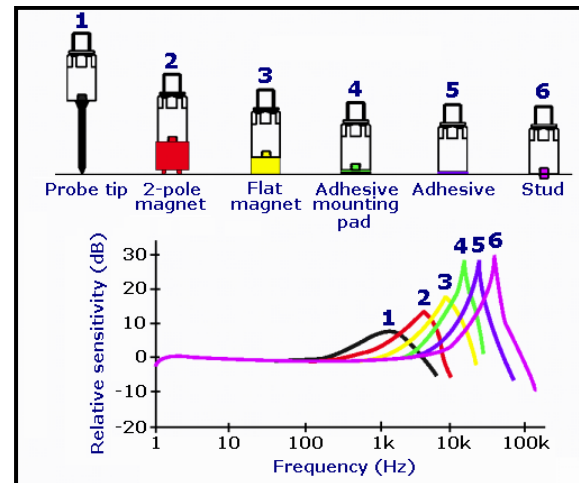
Transducer Frequency Response - Magnets on Flat Surfaces



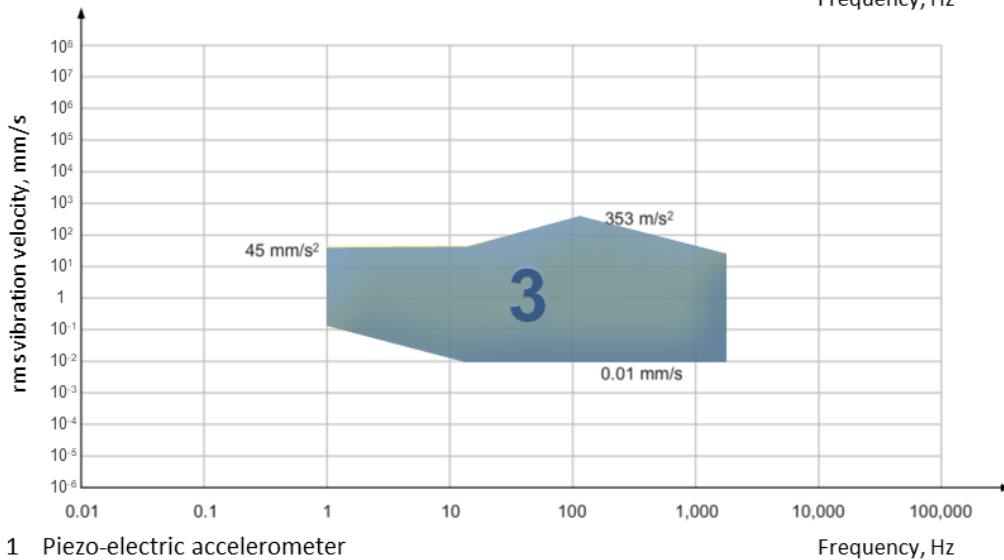
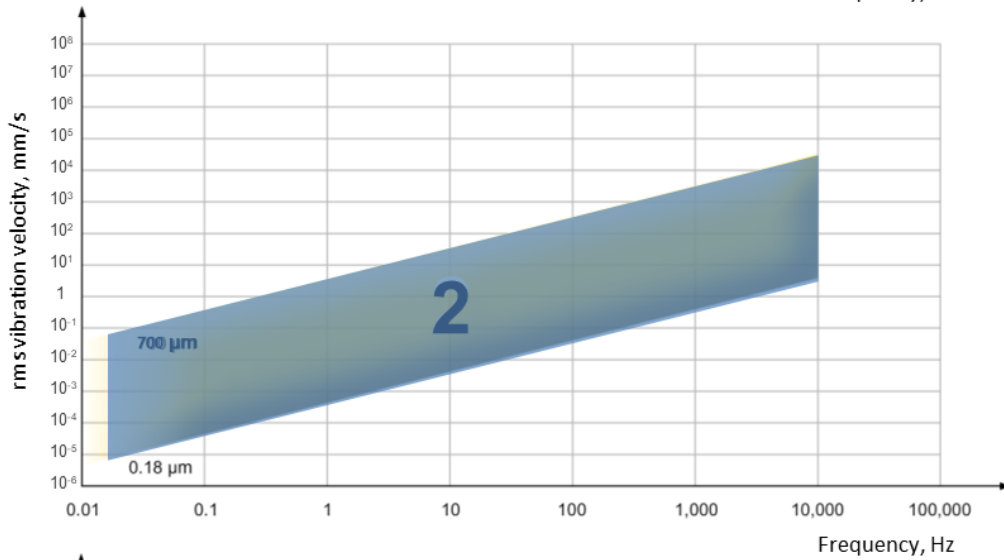
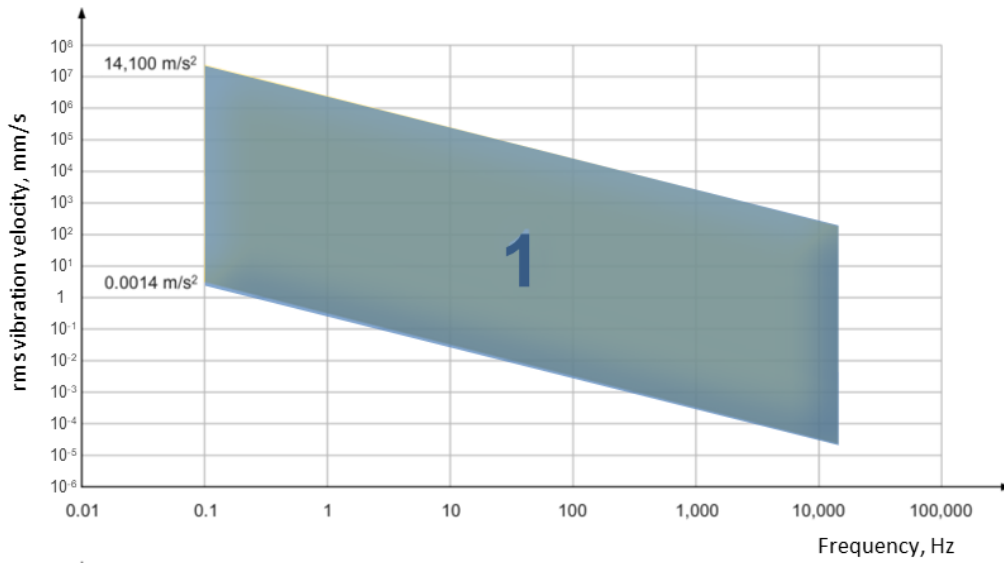
Transducer Frequency Response - Stingers or Hand Held Probes



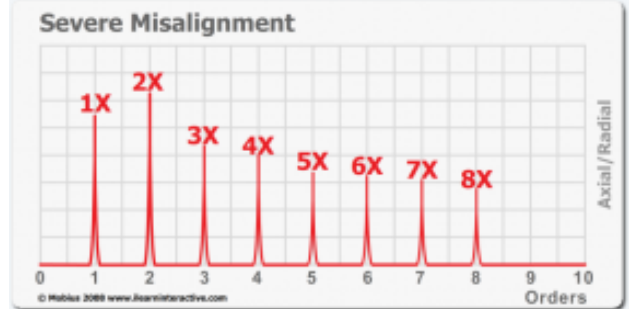
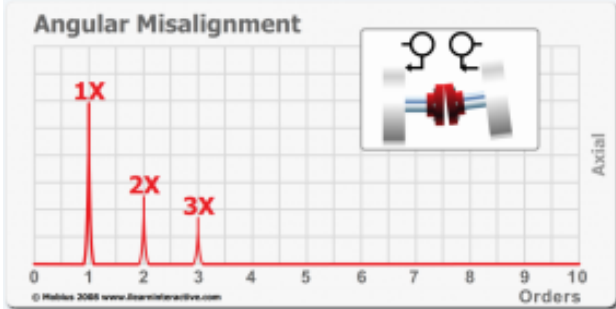
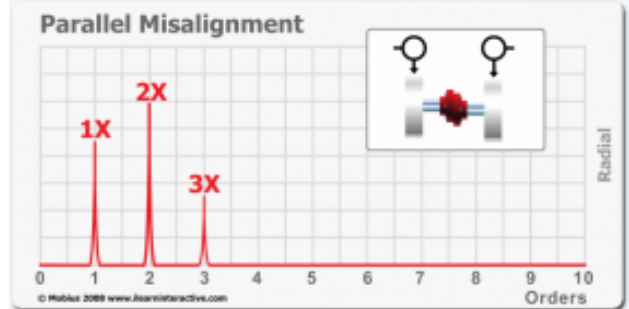
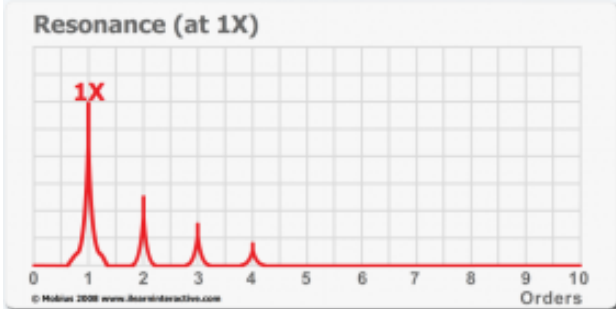
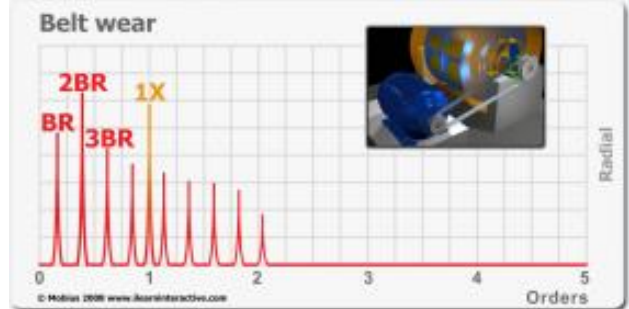
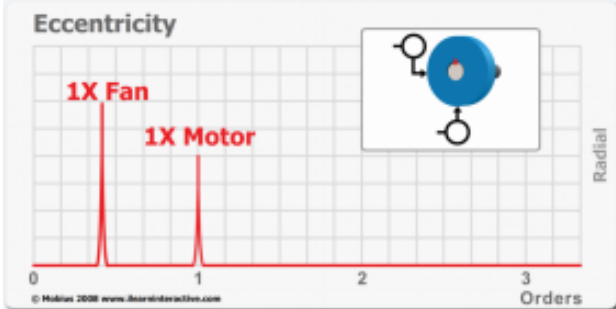
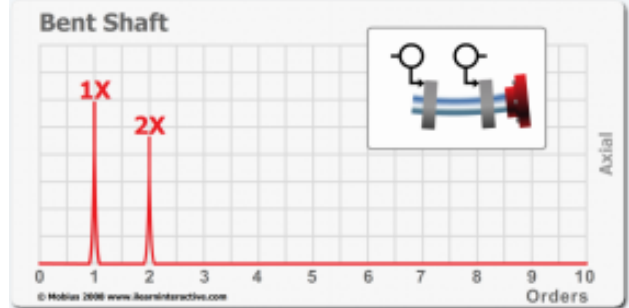
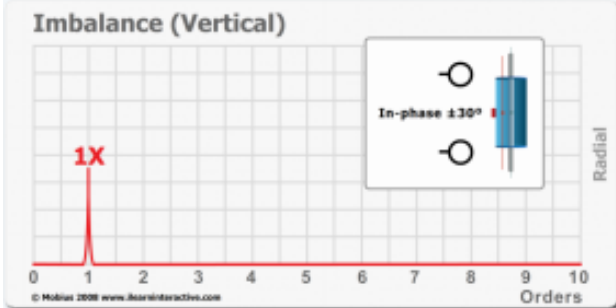
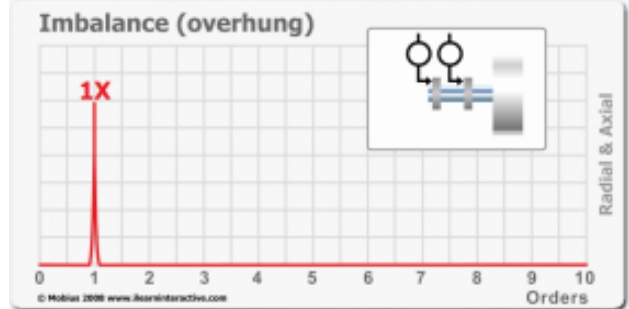
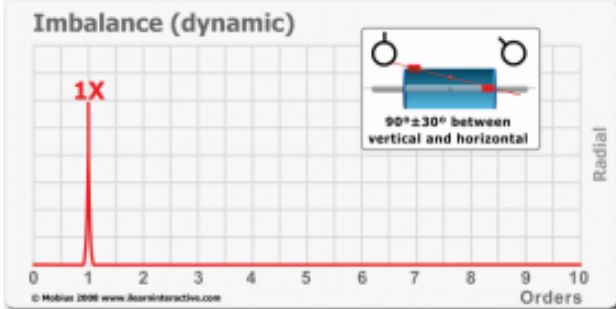
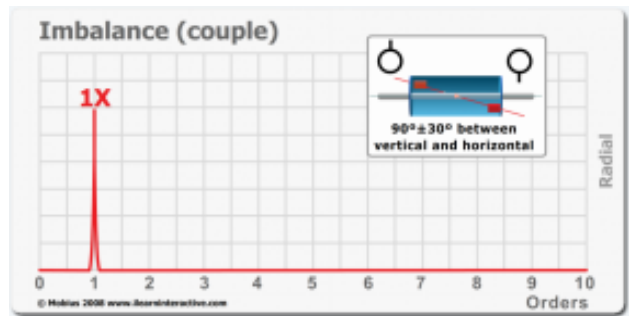
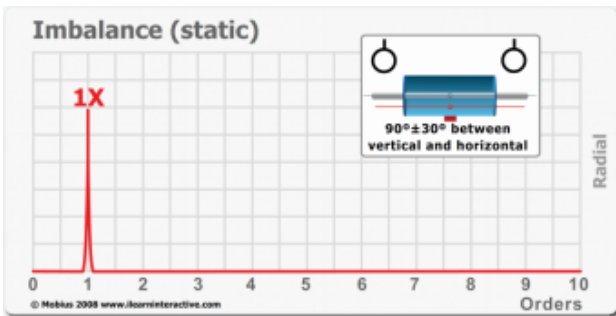
Transducer Frequency Response Curves

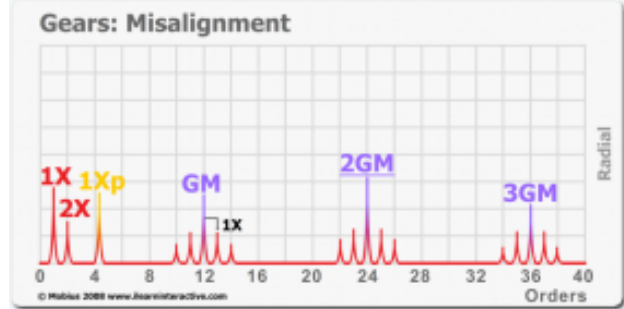
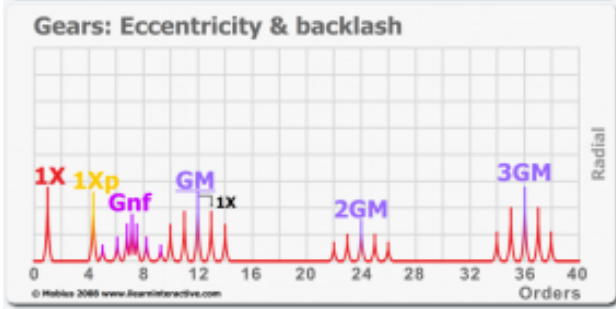
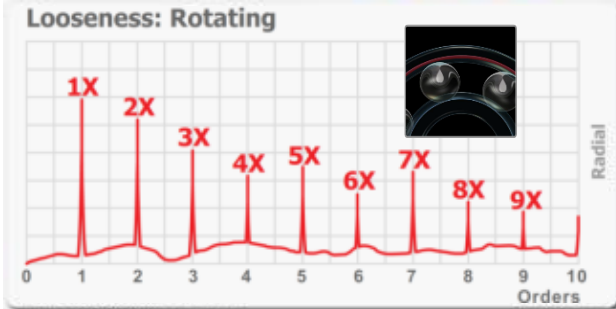
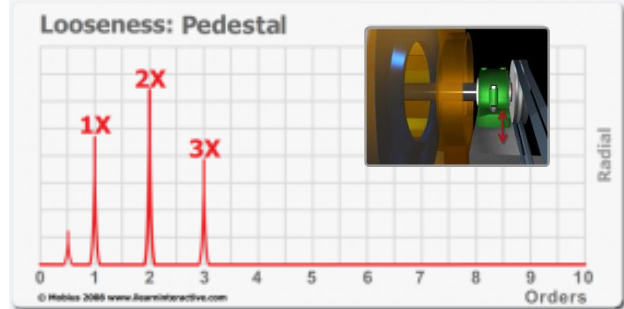
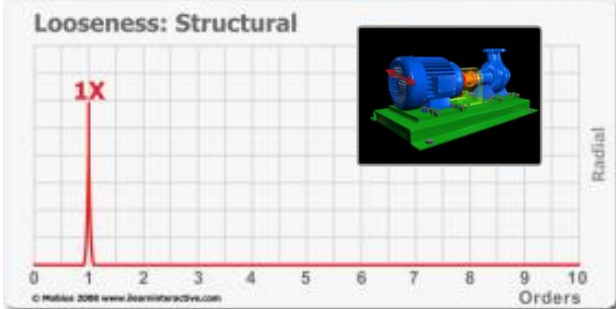
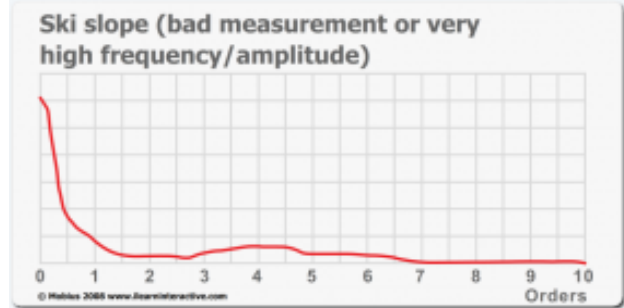
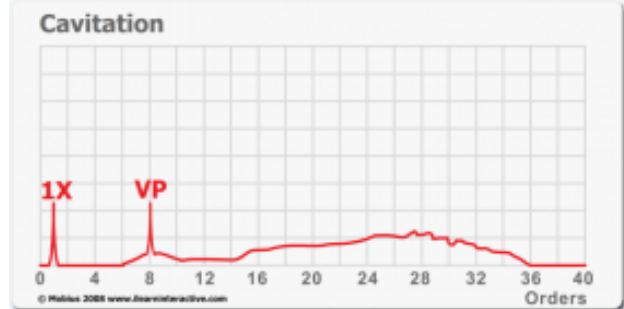
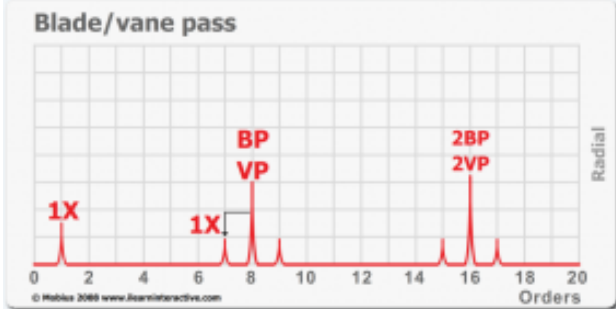
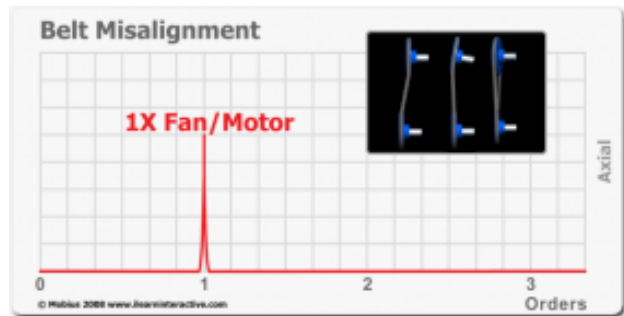
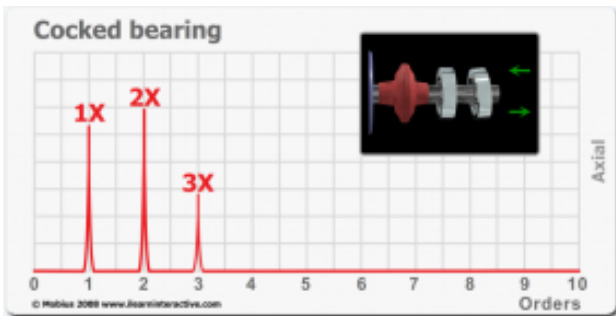


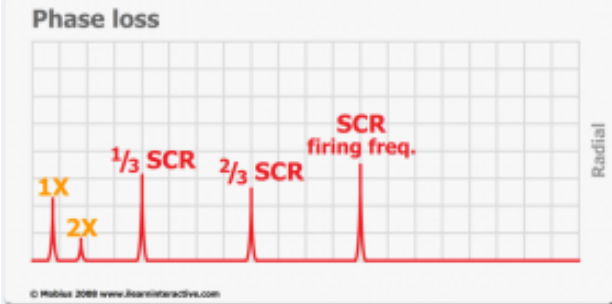
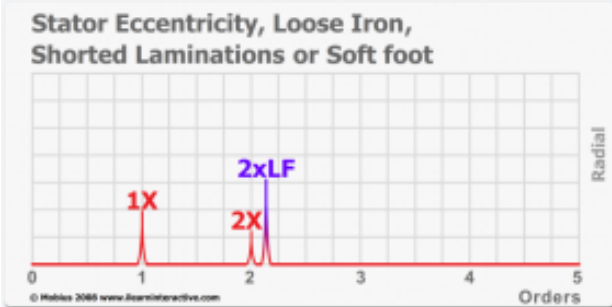
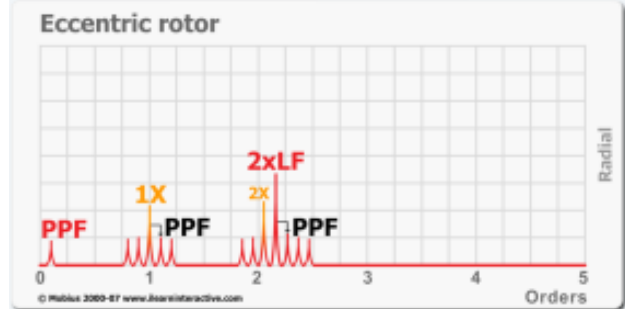
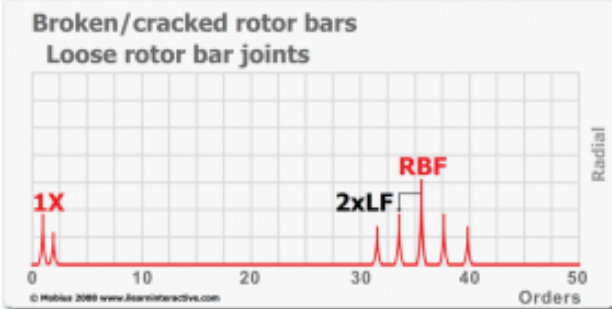
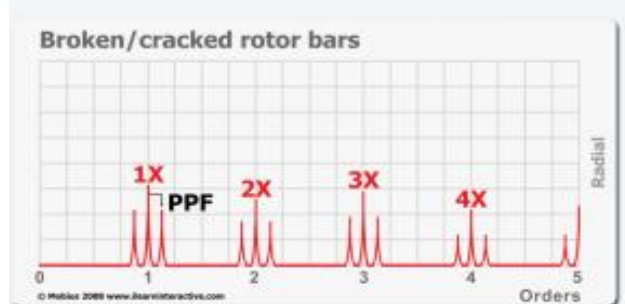
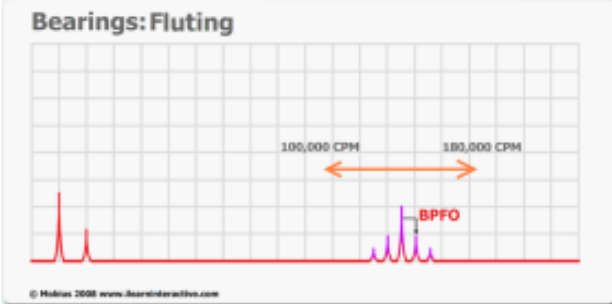
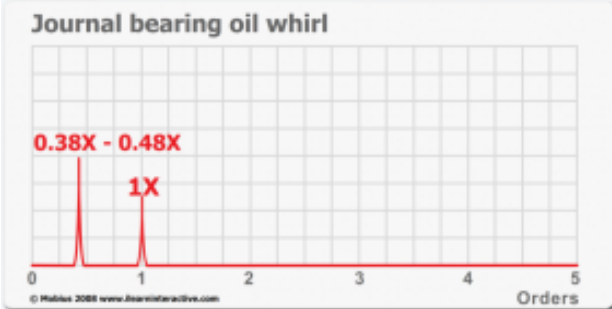
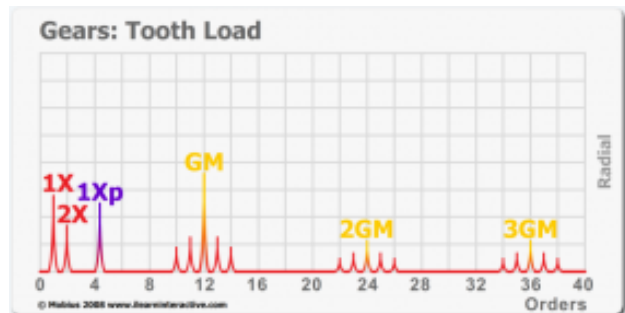
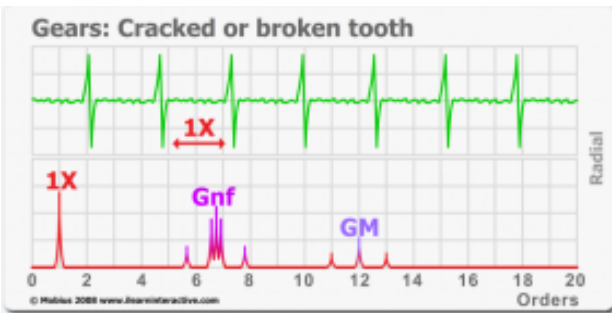
Transducer Effectiveness Regions

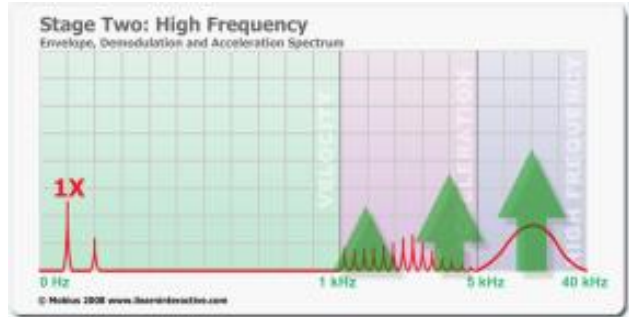
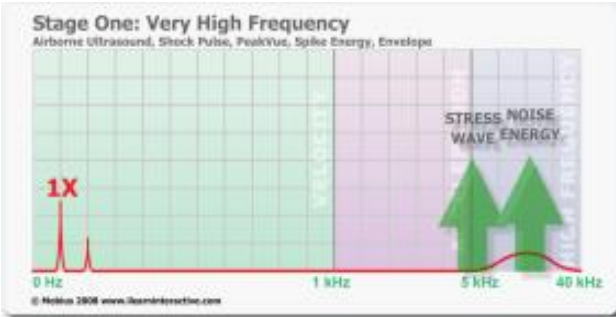
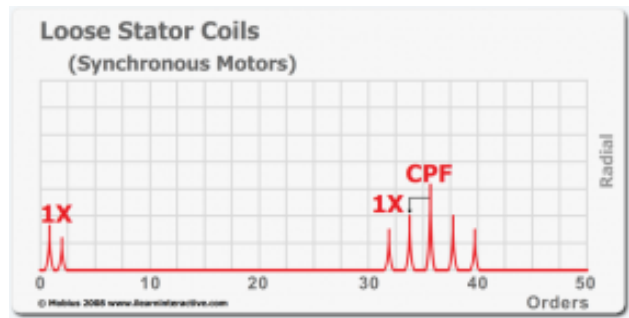
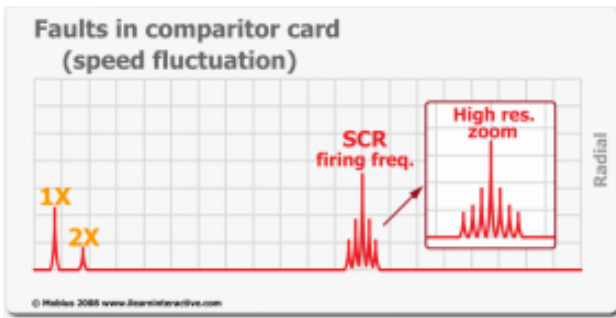


- 1 Piezo-electric accelerometer
- 2 Eddy-current proximity probe
- 3 Electro-mechanical velocity transducer



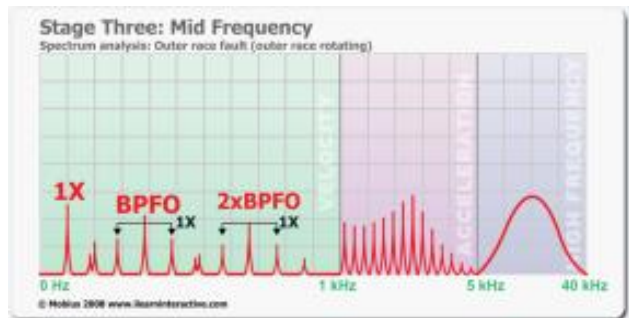
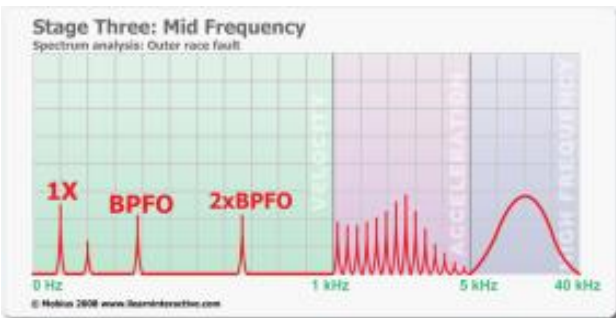






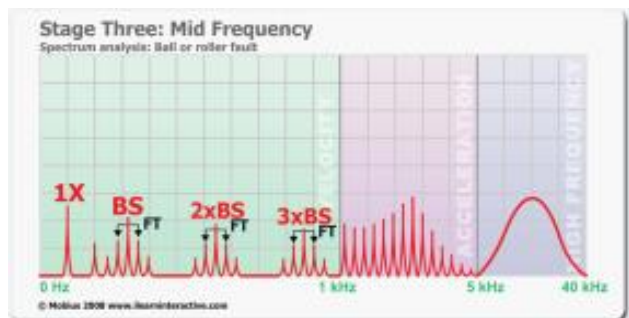
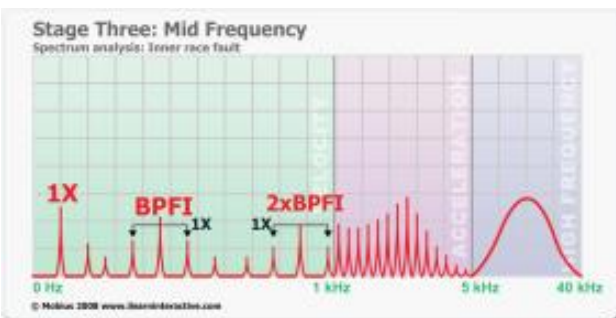
Stage One: Airborne Ultrasound, Shock Pulse, PeakVue, Spike Energy, Envelope

Stage Two: Envelope, Demodulation and Acceleration Spectrum



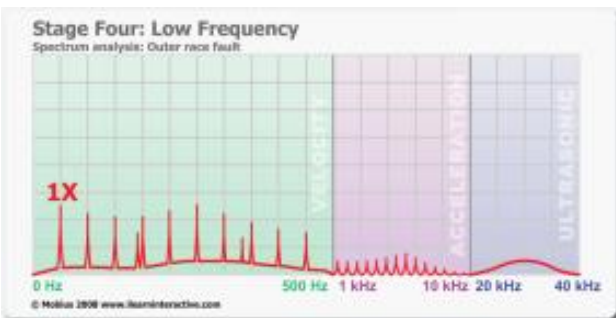
Stage Three: Outer race fault (inner race rotating)

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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