

MATERIAL DE REFERENCIA

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

T = Tiempo requerido para recolectar la forma de onda

Ts = Tiempo entre cada muestra

Fs = Frecuencia de muestreo = Muestras por segundo

N = Número de muestras (1024, 2048, 4096, etc.)

$$\text{Resolución} = \frac{F_{max}}{\text{líneas}}$$

$$\text{Ancho de Banda} = \text{Resolución} \times \text{Factor de ventana}$$

Factor de ventana = 1 (sin ventana/uniforme/rectangular) o 1.5 (Hanning)

Frecuencia de separación $\geq 2 \times$ ancho de banda $\geq 2 \times$ Resolución * factor de ventana

Líneas espectrales requeridas $\geq 2 \times$ Factor de ventana \times Fmax / Frec. de separación

Exactitud de la frecuencia (en el pico) = $\pm \frac{1}{2} \times$ Resolución

Números primos: 1, 3, 5, 7, 11, 13, 17, 19...

1 inch = 25,4 mm

1mm = 0,039 inches

Cálculo de Peso de Prueba:

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

F = 10% de la masa del rotor dividida entre el número de rodamientos en kg.

K = 0,011

N = RPM/1000

R = Radio en cm

Conversion de unidades

$D_{pk-pk} = \frac{19098 V_{pk}}{f_{cpm}} \quad V_{pk} = \frac{5217 A_{rms}}{f_{cpm}}$	$D_{pk-pk} = \frac{27009 V_{rms}}{f_{cpm}} \quad V_{rms} = \frac{93712 A_{rms}}{f_{cpm}}$
$D_{pk-pk} = \frac{9.958 \times 10^7 A_{rms}}{f_{cpm}^2} \quad A_{rms} = \frac{f_{cpm} V_{pk}}{5217}$	$D_{pk-pk} = \frac{2.53 \times 10^9 A_{rms}}{f_{cpm}^2} \quad A_{rms} = \frac{f_{cpm} V_{rms}}{93712}$
$V_{pk} = \frac{f_{cpm} D_{pk-pk}}{19098} \quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{9.958 \times 10^7}$	$V_{rms} = \frac{f_{cpm} D_{pk-pk}}{27009} \quad A_{rms} = \frac{f_{cpm}^2 D_{pk-pk}}{2.53 \times 10^9}$
<p>D = Desplazamiento: mils pk-pk V = Velocidad: in/sec pk A = Aceleración: g rms F = Frecuencia: CPM</p>	<p>D = Desplazamiento: micras pk-pk V = Velocidad: mm/sec rms A = Aceleración: g rms F = Frecuencia: CPM 1 g rms = 9,8 m/sec²</p>




ISO 10816-3 Tabla de severidad de vibraciones

				Velocity 10-1000Hz > 600rpm 2-1000Hz > 120rpm	
D					
			11		0.43
			7.1		0.28
			4.5		0.18
			3.5		0.14
			2.8		0.11
			2.3		0.09
			1.4	0.06	
			0.71	0.03	
rigid	flexible	rigid	flexible	Foundation	
medium sized machines 15kW < P ≤ 300kW		large machines 300kW < P < 50MW		Machine Type	
motors 160mm ≤ H < 315mm		motors 315mm ≤ H			
Group 2		Group 1		Group	

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

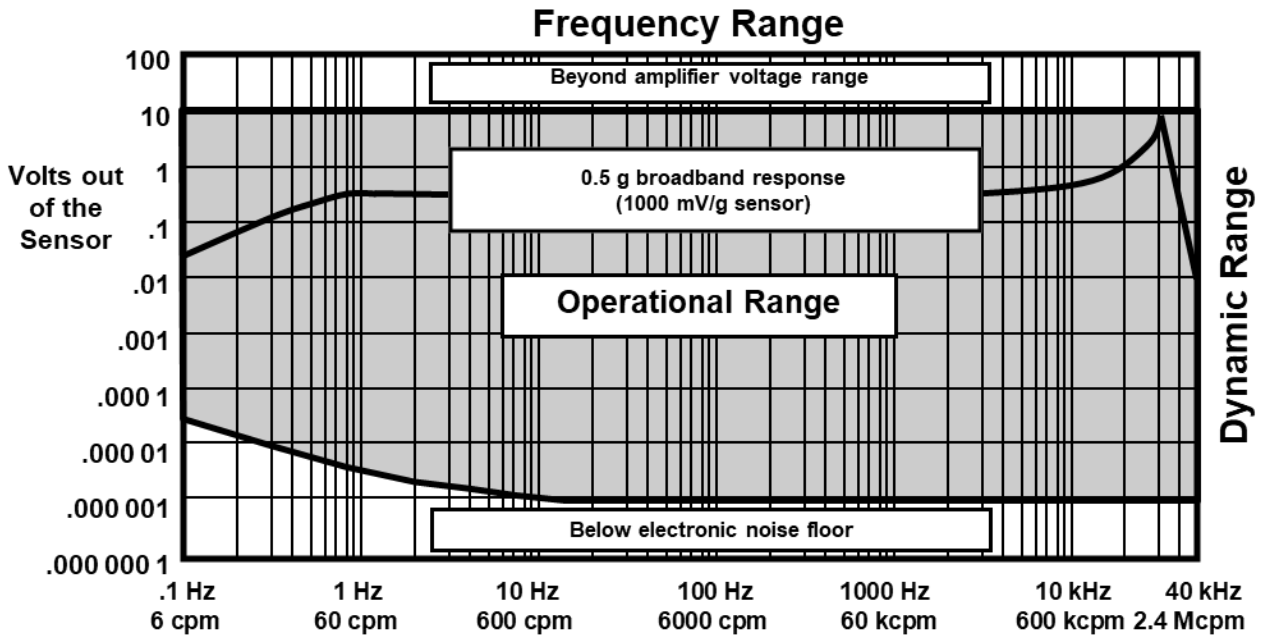
If the lowest natural frequency of the combined machine and support system in the direction of measurement is higher than its main excitation frequency (this is in most cases the rotational frequency) by at least 25 %, then the support system may be considered rigid in that direction. All other support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

ISO 10816-3 Tabla de severidad de vibraciones

				140	5.51	Displacement 10-1000Hz r > 600rpm 2-1000Hz r > 120rpm
	D			113	4.45	
				90	3.54	
	C			71	2.80	
				57	2.24	
	B			45	1.77	
				37	1.46	
				29	1.14	
				22	0.87	
	A			18	0.71	
				11	0.43	
				$\mu\text{m rms}$	mil rms	
rigid	flexible	rigid	flexible	Foundation		
medium sized machines 15kW < P ≤ 300kW		large machines 300kW < P < 50MW		Machine Type		
motors 160mm ≤ H < 315mm		motors 315mm ≤ H				
Group 2		Group 1		Group		

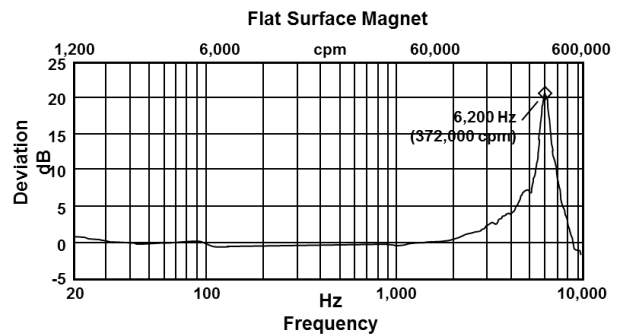
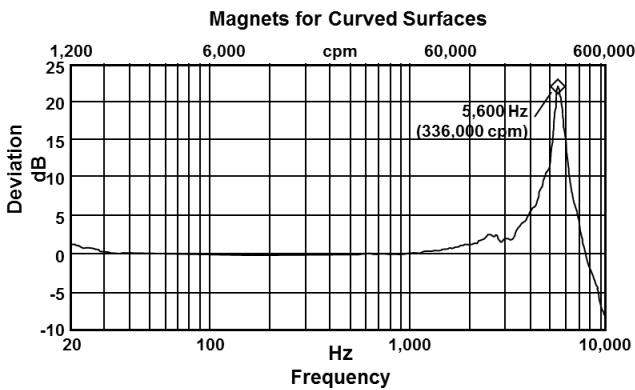
-  New machine condition
-  Short-term operation allowable
-  Unlimited long-term operation allowable
-  Vibration causes damage

Regiones de operación de transductores



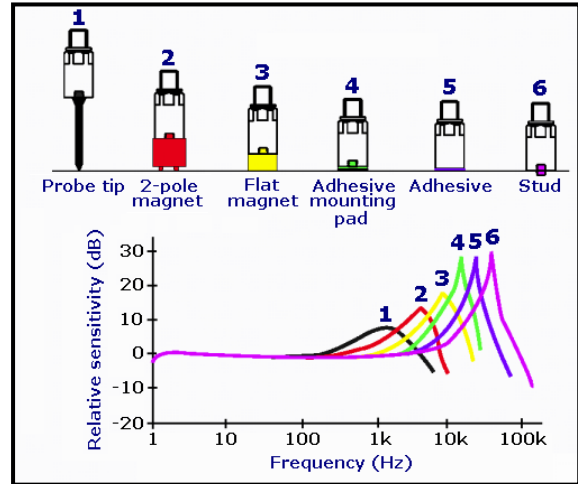
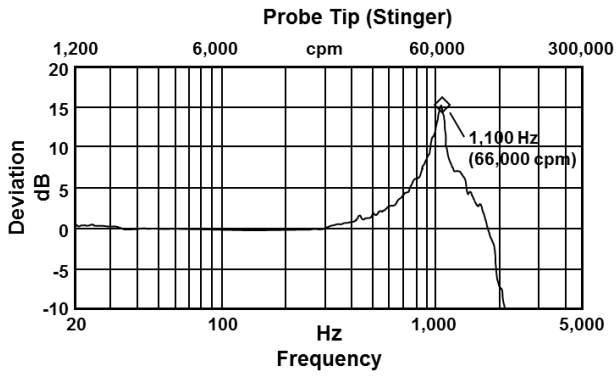
Frecuencia de respuesta de acelerómetros – Imanes para superficies curvas

Frecuencia de respuesta de acelerómetros – Imanes para superficies planas

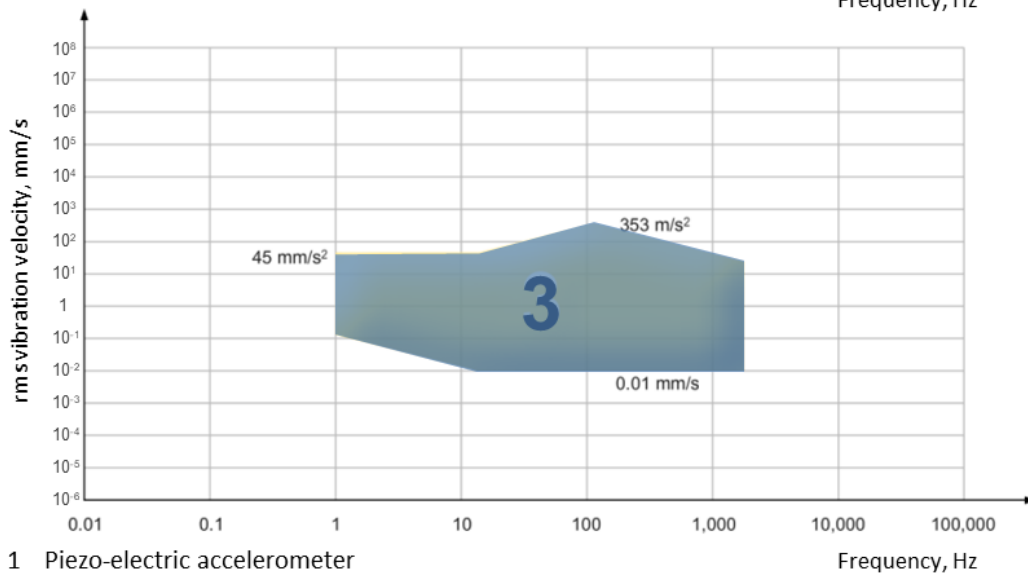
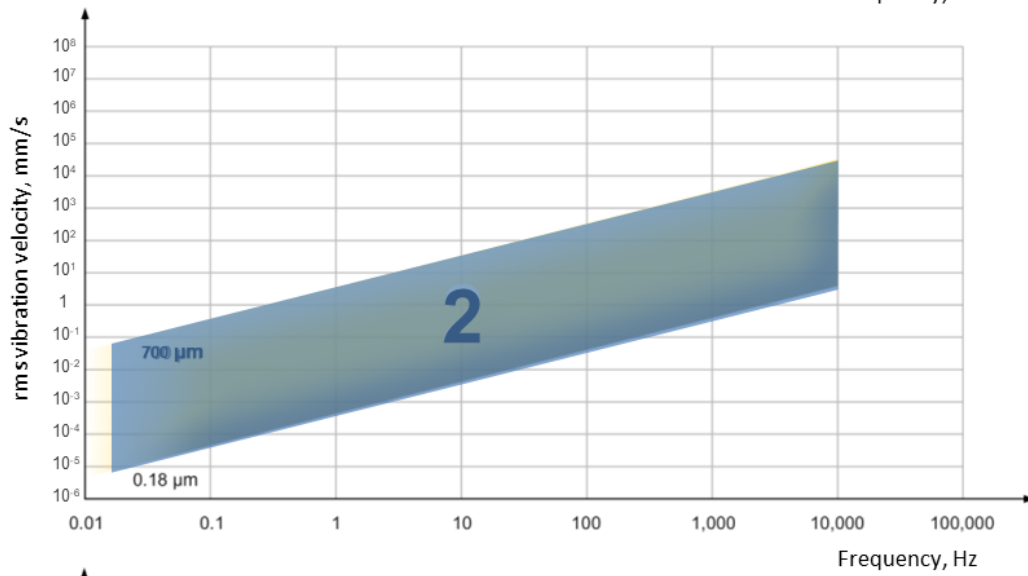
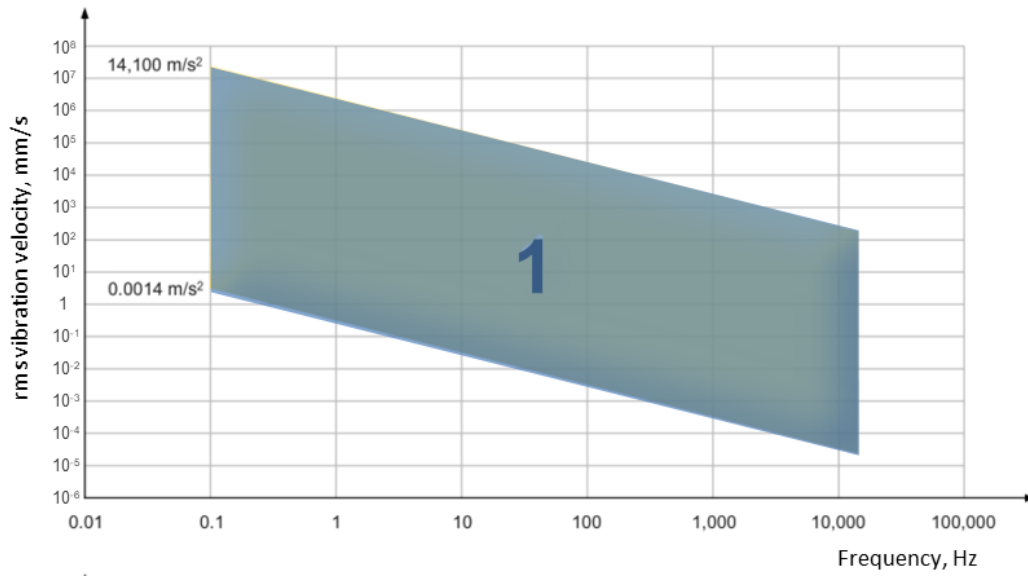


Frecuencia de respuesta de acelerómetros – Punteros o varillas

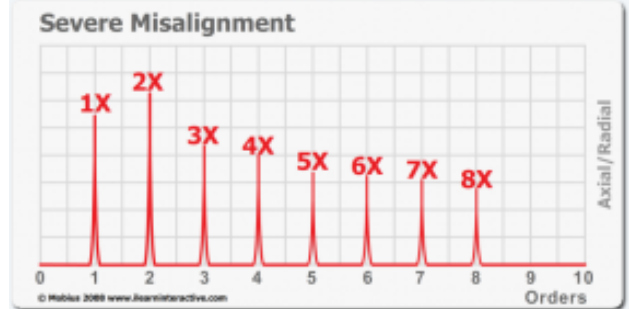
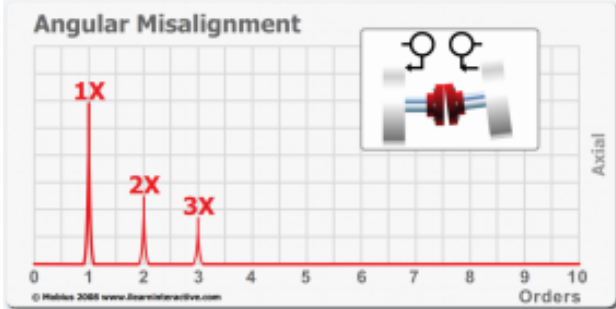
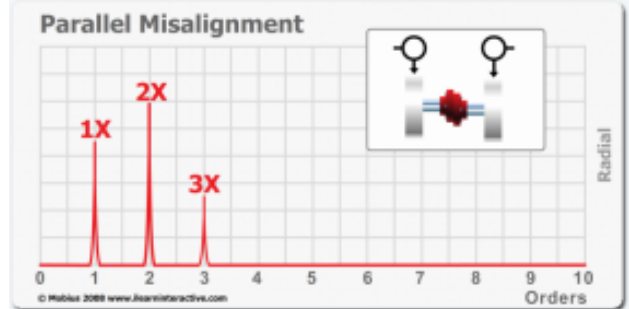
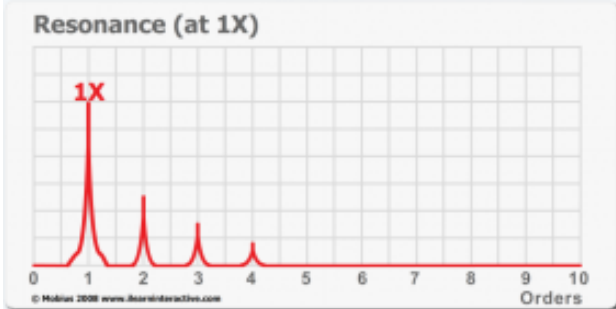
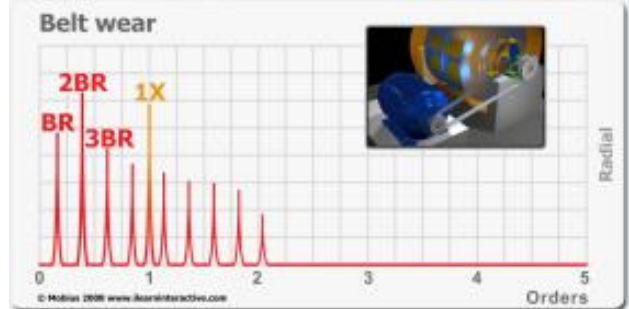
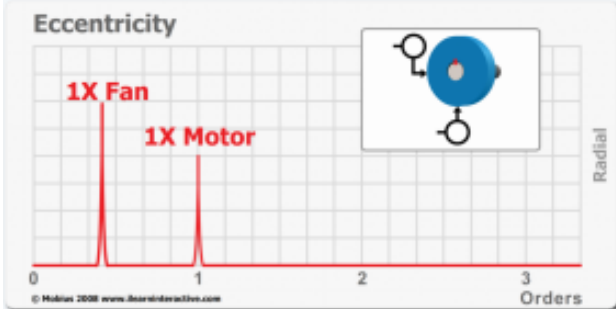
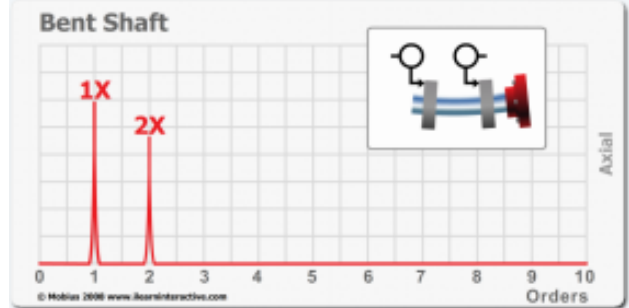
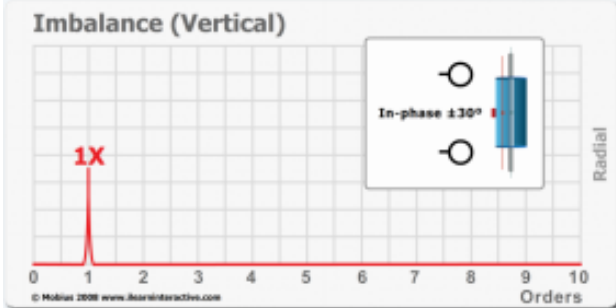
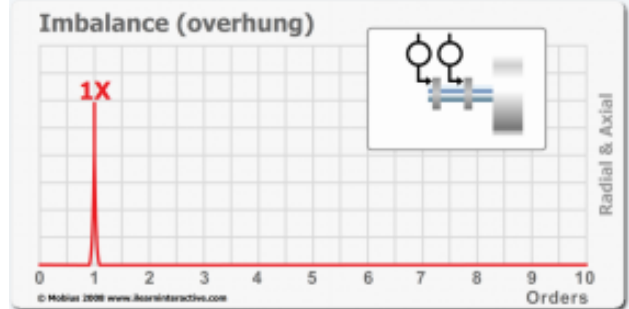
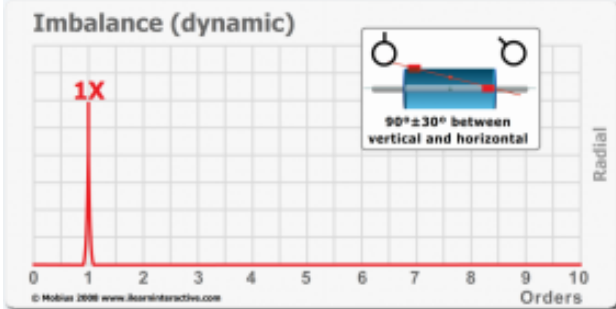
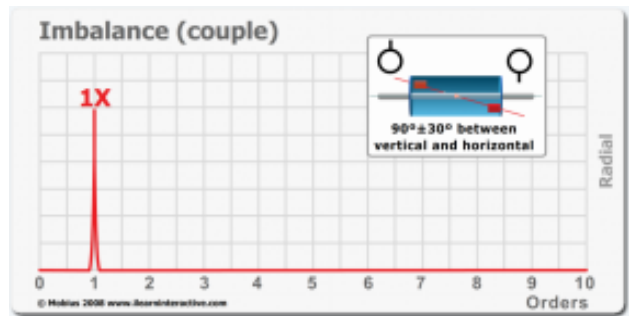
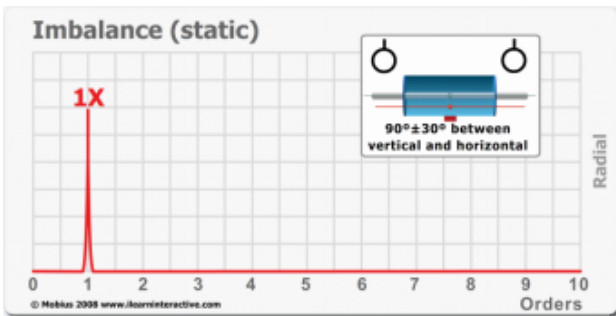
Curvas de respuesta de acelerómetros

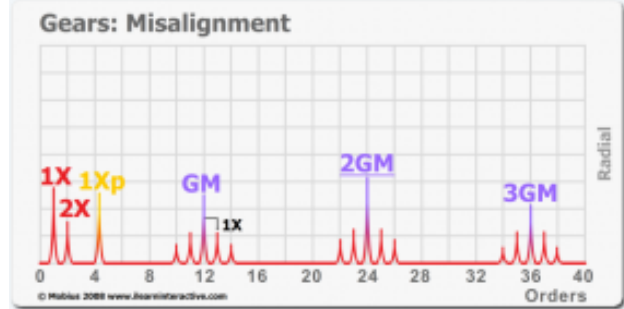
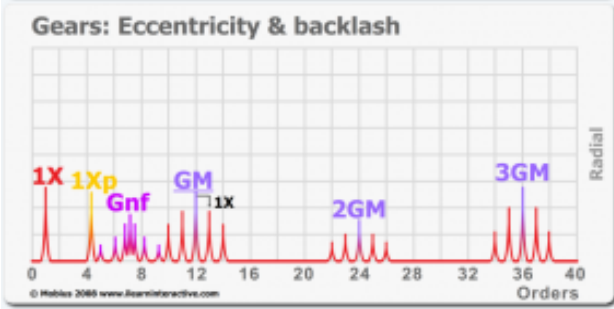
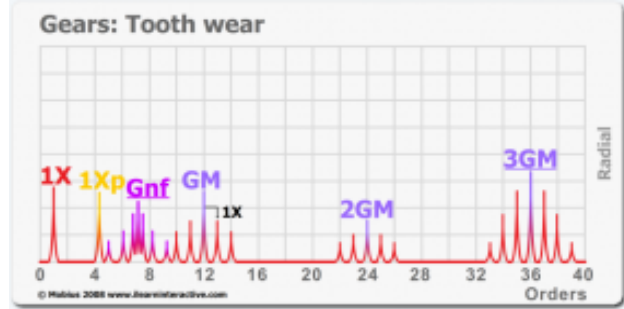
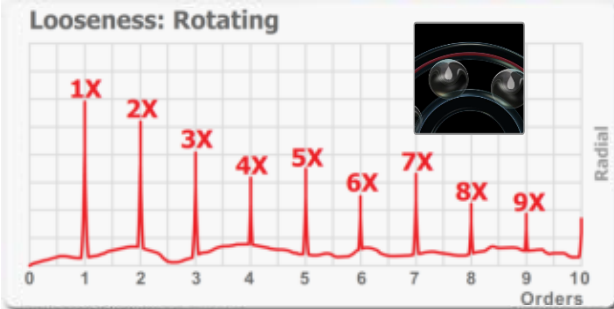
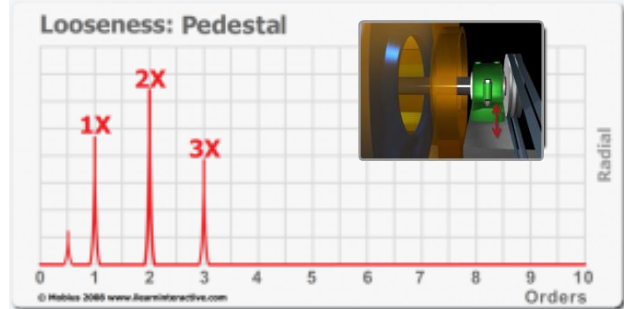
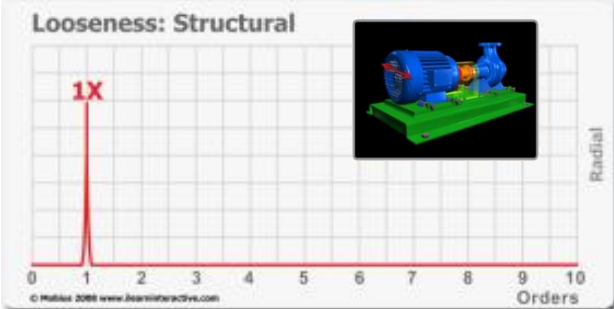
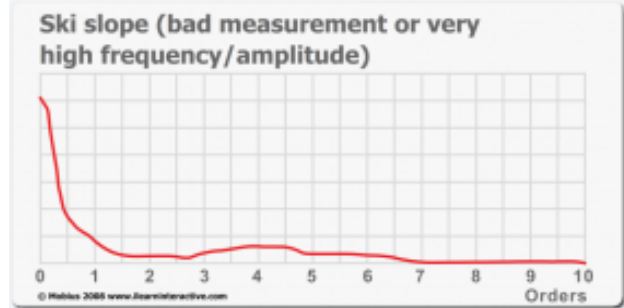
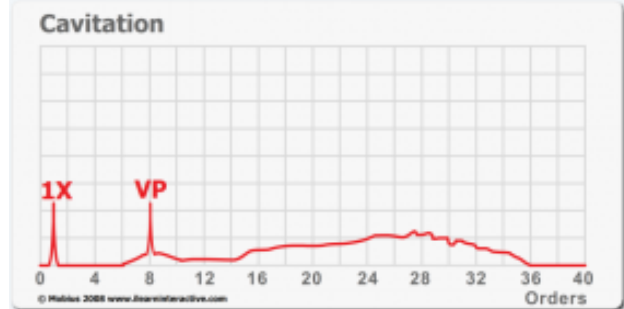
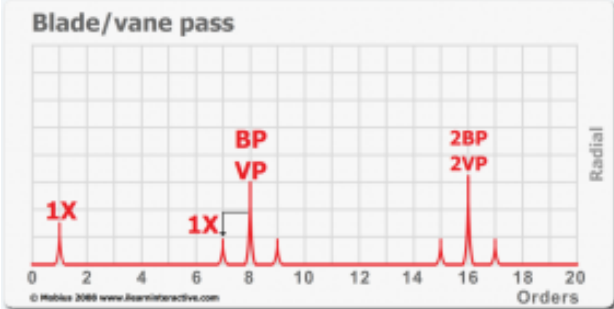
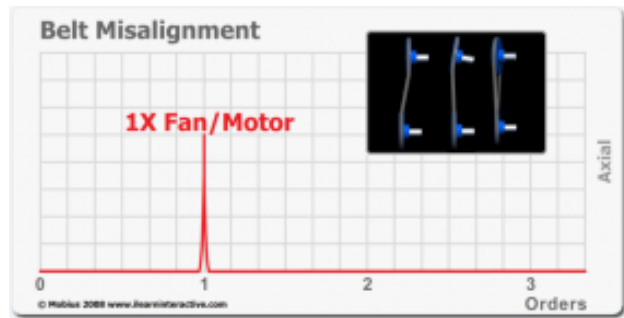
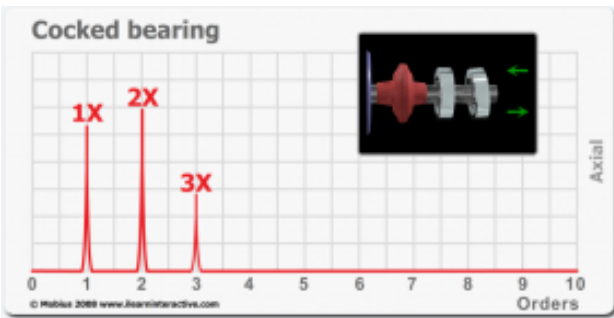


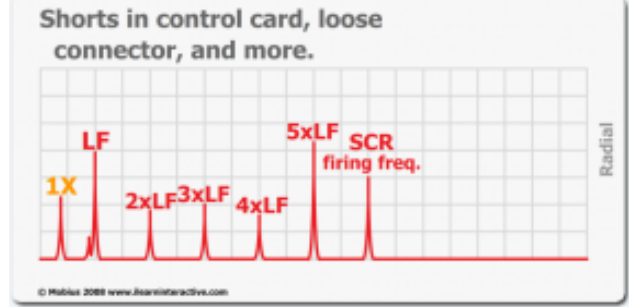
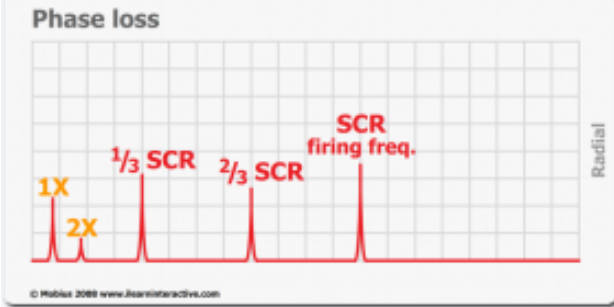
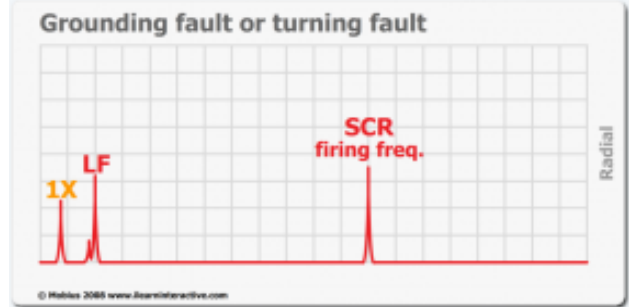
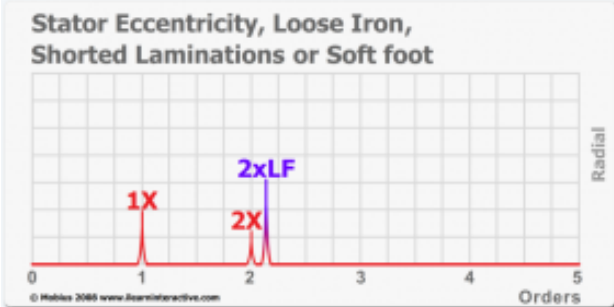
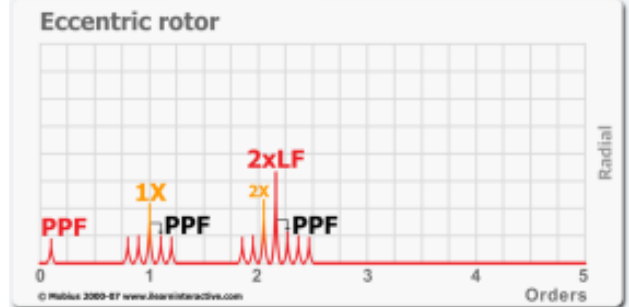
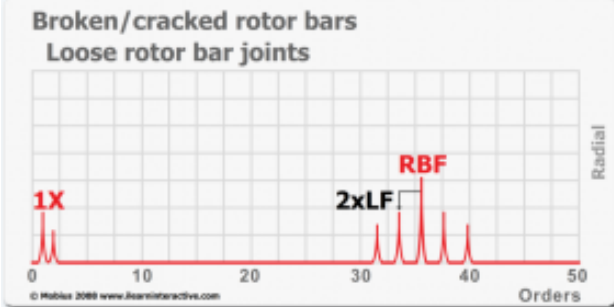
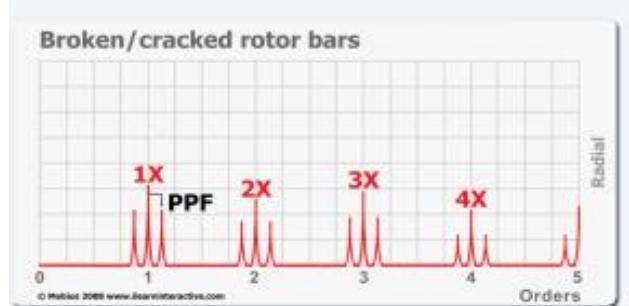
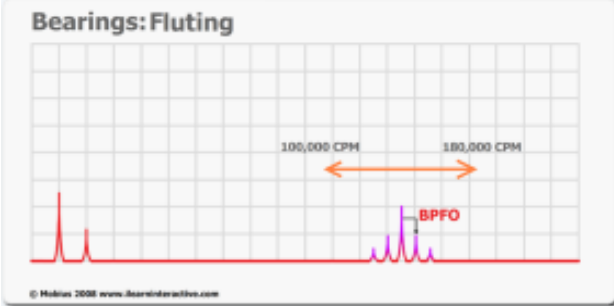
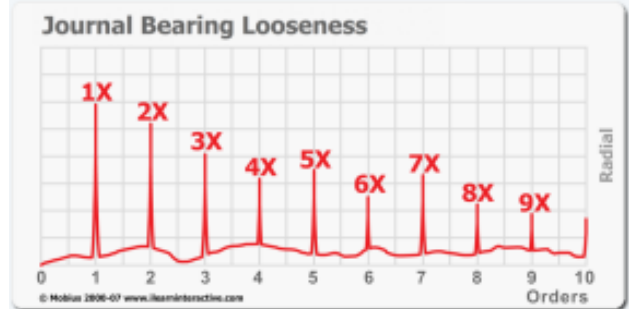
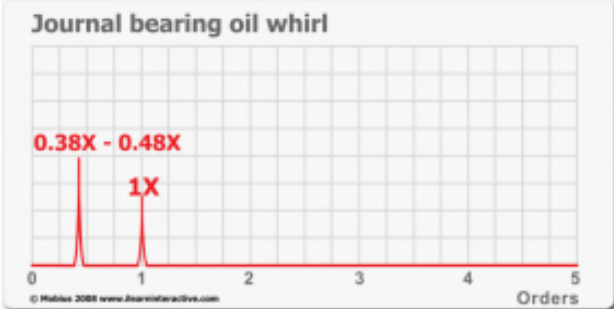
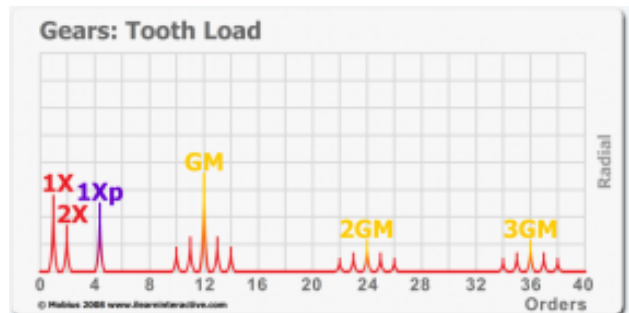
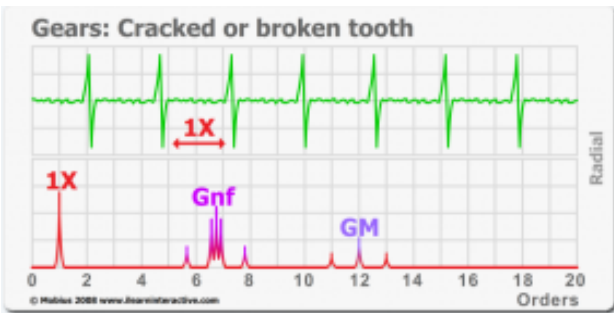
Regiones de efectividad de las unidades

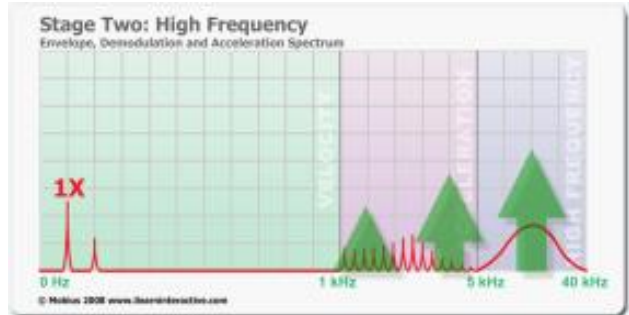
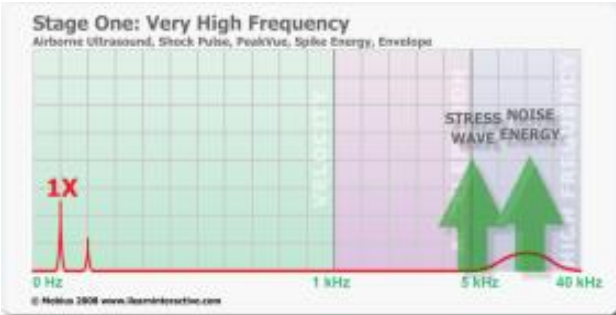
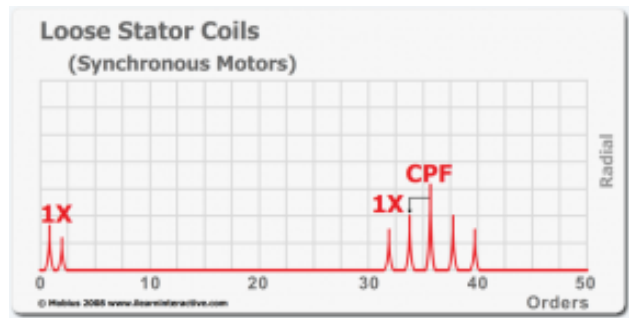
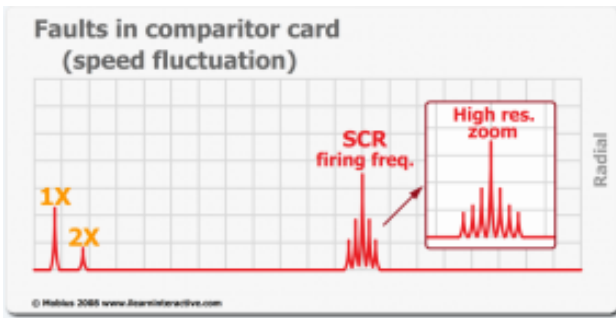


- 1 Piezo-electric accelerometer
- 2 Eddy-current proximity probe
- 3 Electro-mechanical velocity transducer



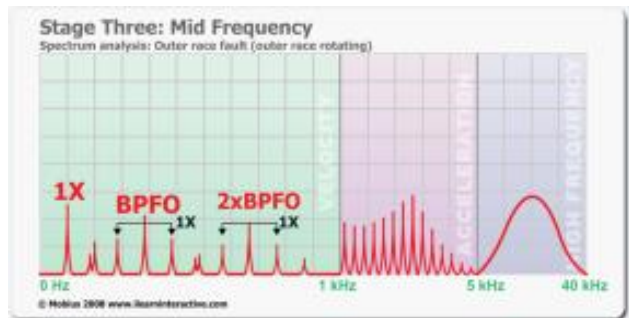
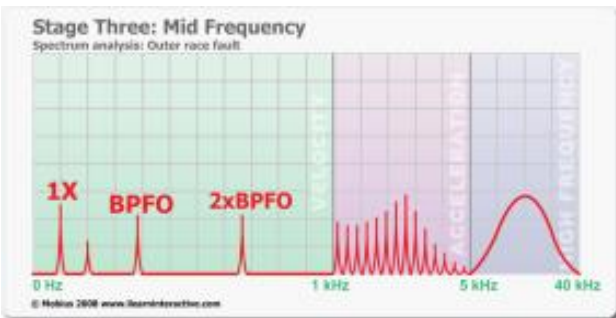






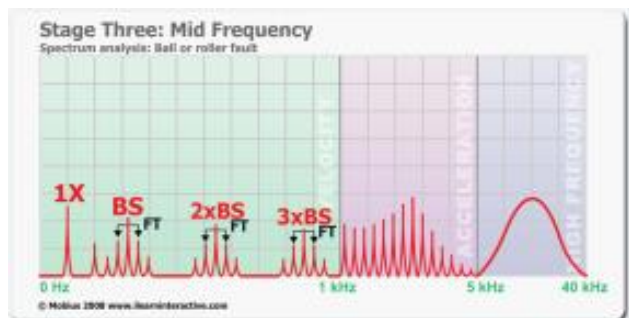
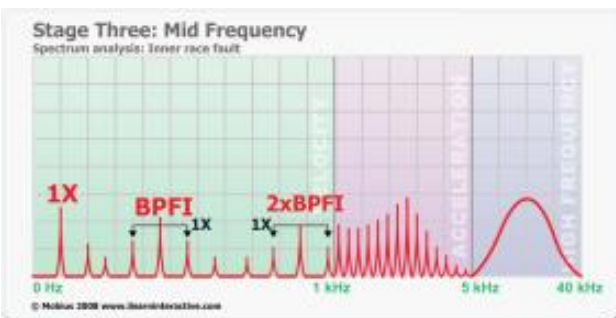
Etapas 1: Ultrasonido Aéreo, Shock Pulse, PeakVue, Spike Energy, Envelope

Etapas 2: Envelope, Demodulación y Espectro de Aceleración



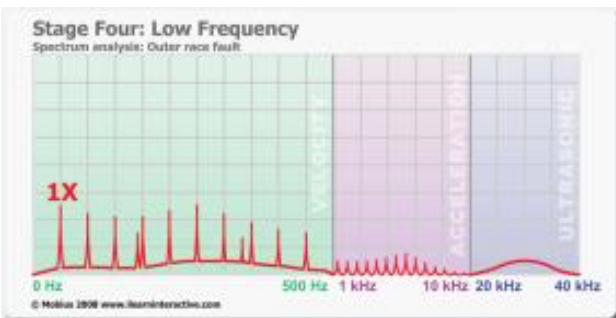
Etapas tres: Fallo de la pista externa (pista interior girando)

Etapas tres: Fallo de la pista externa (pista exterior girando)



Etapas tres: Fallo de la pista interna (pista interior girando)

Etapas 3: Fallo de bola o rodillo (pista interior girando)



Etapas 4

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