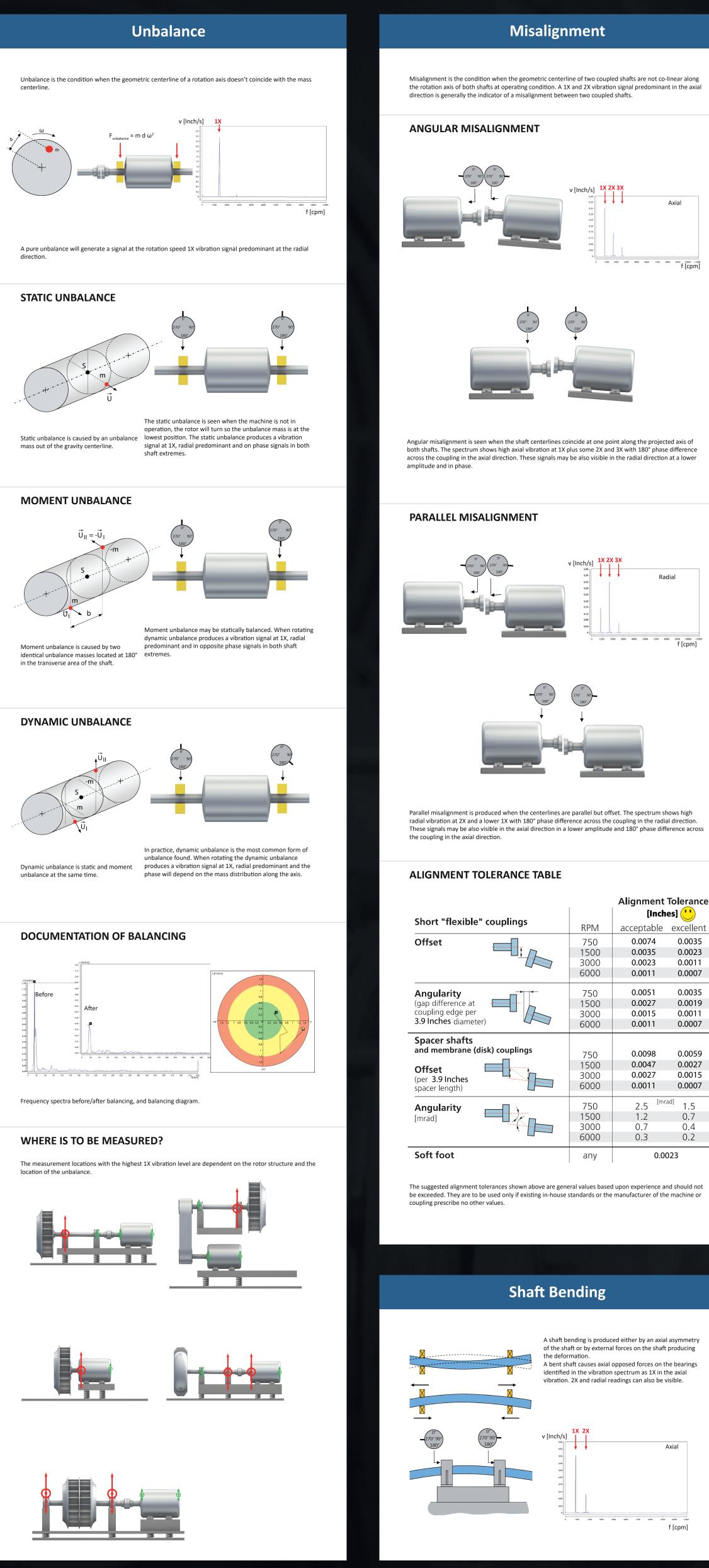
## -MACHINERY FAULT DIAGNOSIS -////--- db prufted



A shaft bending is produced either by an axial asymmetry of the shaft or by external forces on the shaft producing the deformation A bent shaft causes axial opposed forces on the bearings identified in the vibration spectrum as 1X in the axial vibration. 2X and radial readings can also be visible. v [Inch/s]

v [Inch/s] 1X 2X 3X

v [Inch/s] 1X 2X 3X

RPM

750

1500

3000

750

1500

3000

3000

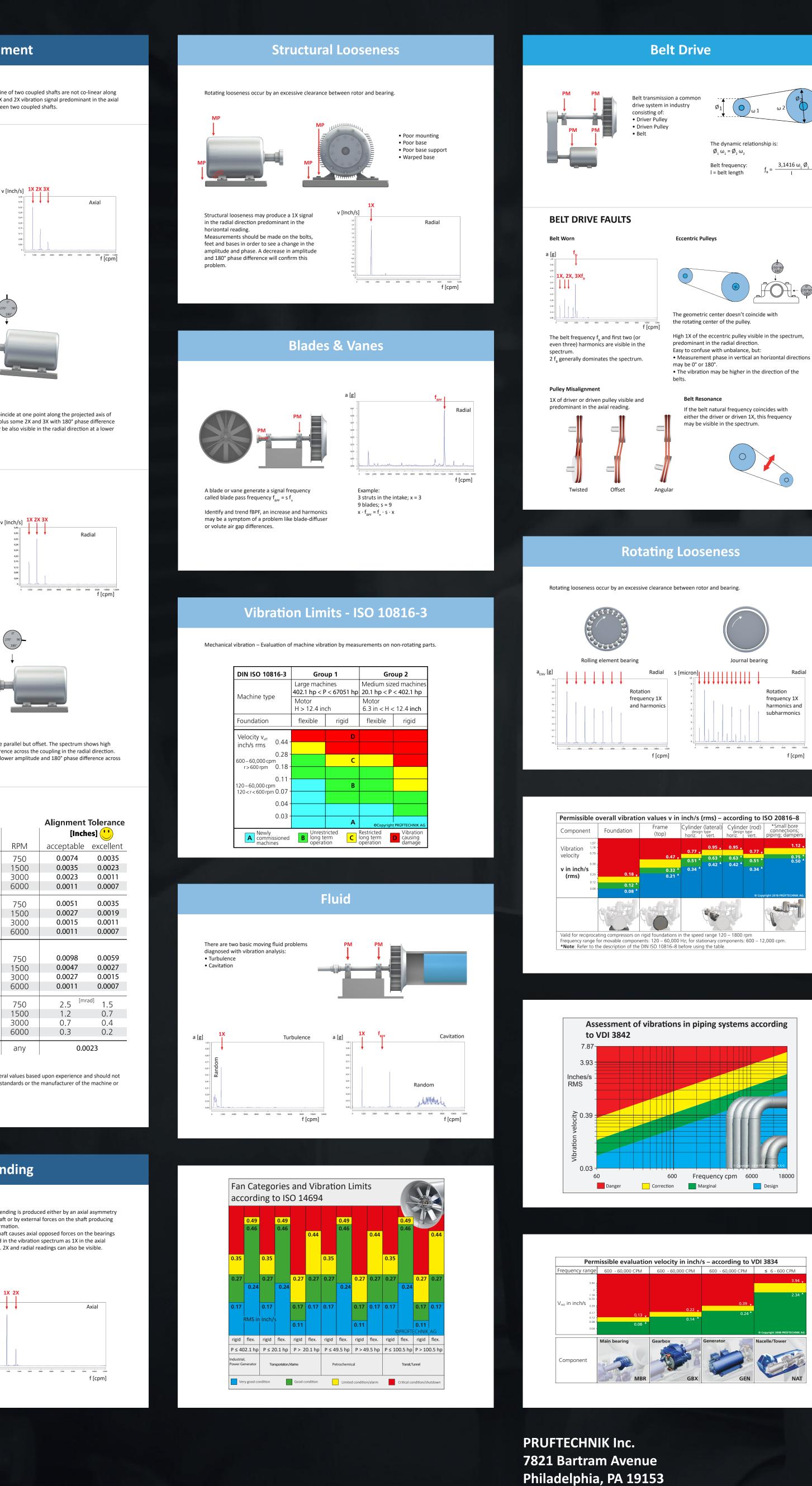
750

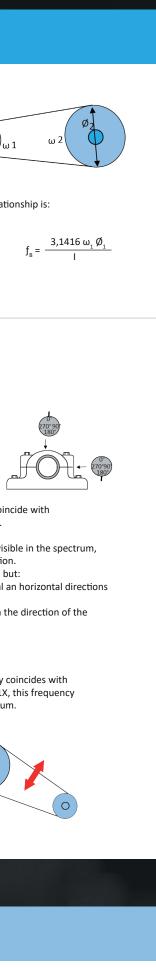
1500

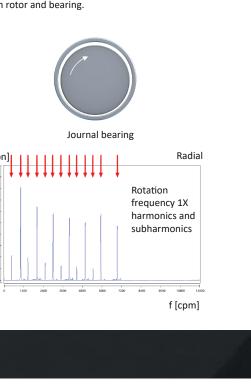
3000

any

6000

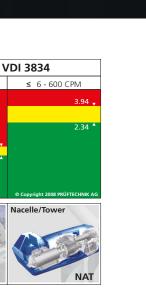










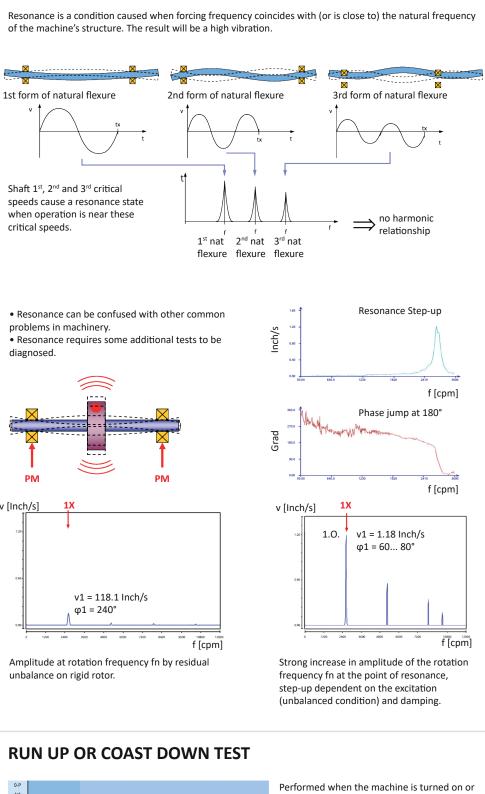


E-Mail: info.na@pruftechnik.com

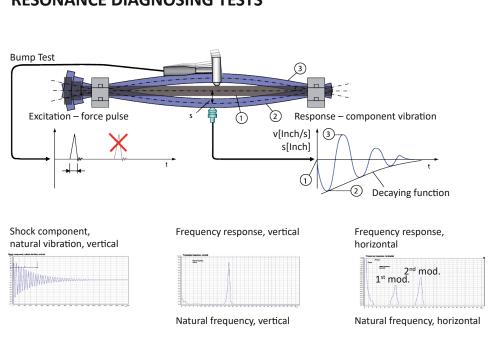
Tel.: +1 844 242-6296

Fax: +1 215 893-3902

## Resonance



**RESONANCE DIAGNOSING TESTS** 

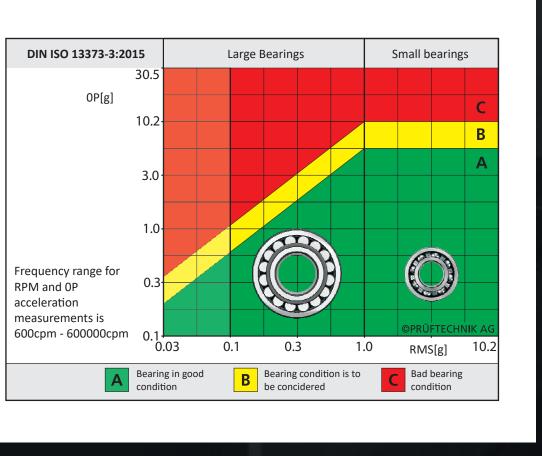


turned off.

Series of spectra at different vibration signals

The use of tachometer is optional and the data collector must support this kind of test.

tracking may reveal a resonance.



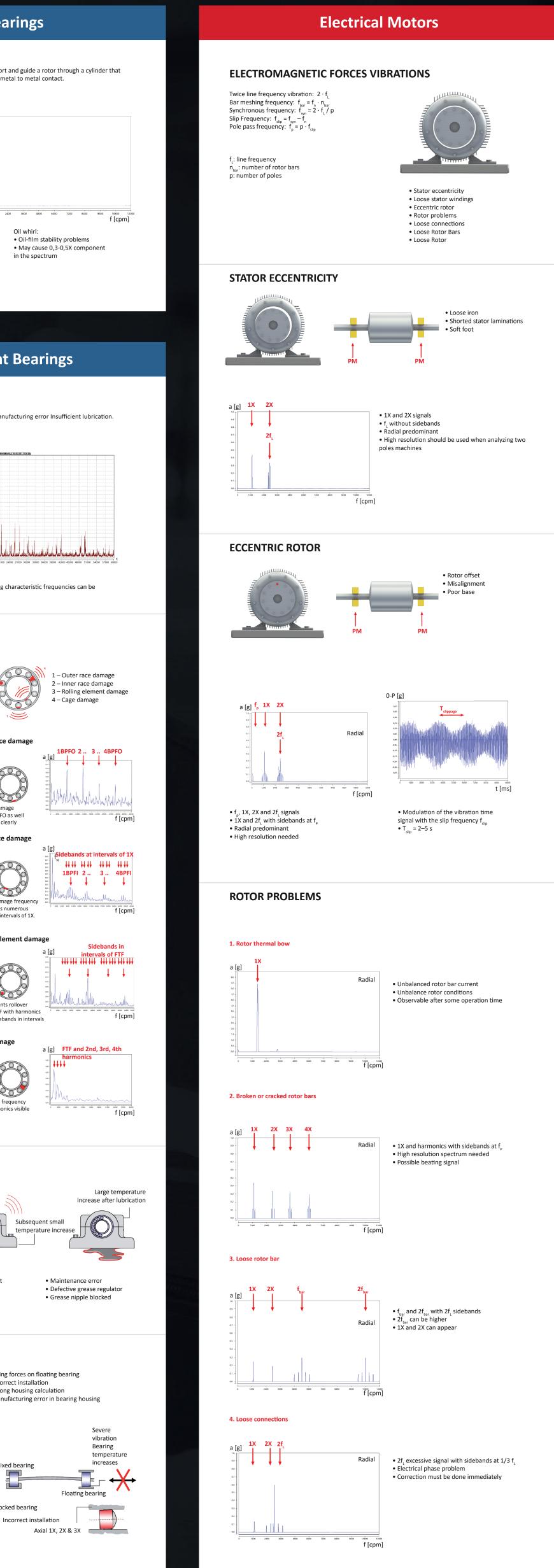
DIN ISO 10816-7	Category 1			Categ	ory 2		
Pump type	Rotodynamic pumps with high reliability, availability or security requirements.			Rotodynamic pumps for general or less critical applications.		r < 600 rpm 0.5 rpm 1.0 rpm	
Power	< 200 kW	> 200 kW		< 200 kW	> 200 kW		2.0 rpm
Velocity v <sub>eff</sub> 0.3	D		0.37 -	D		ement	D
0.26 600-60,000 cpm r > 600 rpm 0.2	С		0.33 · 0.24 ·	C		Displacement S <sub>P-P</sub>	
0.16 120–60,000 cpm r < 600 rpm 0.14	В		0.2 · 0.17 ·	В		5.12 3.15	С
0.1 inch/s			0.16 · inch/s.			1.97 mil	В
rms	A		rms	Α	©Copyri	ght PRÜFTE	нлік ад <b>А</b>
	A Newly commiss machine	ioned <b>B</b>	Unresti long te operati	rm C	Restricted long term operation	D	Vibration causing damage

PRUFTECHNIK Maintenance Technology Service Inc. 4406, Louis-B.-Mayer Street Laval, QC H7P 0G1 E-Mail: info.ca@pruftechnik.com Tel.: 514-738-6565 Toll Free:1-877-778-3832

Jour	nal Bearings
Journal bearings provide a very low friction s surrounds the shaft and is filled with a lubric	surface to support and guide a r
High vibration damping due to the oil film: • High frequencies signals may not be transmitted • Displacement sensor and continuous monitoring recommended Clearance problems (rotating mechanical loc	Oil whirl: • Oil-film st • May caus in the spect
Rolling E	lement Bear
WEAR Lifetime exceeded. Bearing overload Incorrec	ct assembly. Manufacturing erro
<figure></figure>	
The vibration spectrum has a higher 'noise' l identified. Increased level of shock pulses.	evel and bearing characteristic f
a angle of contact D pitch diameter d rolling element diameter z number of rolling elements n shaft RPM Ball Pass Frequency, Outer Race $BPFO = \frac{n \cdot Z}{60 \cdot 2} (1 - \frac{d}{D} \cos \alpha)$ Ball Pass Frequency, Inner Race	<image/> <section-header></section-header>
BPFI = $\frac{n \cdot Z}{60 \cdot 2} (1 + \frac{d}{D} \cos \alpha)$ Ball Spin Frequency $2 \cdot BSF = \frac{n \cdot D}{60 \cdot d} (1 - [\frac{d}{D} \cos \alpha]^2)$ Fundamental Train Frequency FTF = $\frac{n}{60 \cdot 2} (1 - \frac{d}{D} \cos \alpha)$ Example of rollover frequencies Ball bearing SKF 6211; n = 2998 RPM Dimensions Rollover frequencies	Inner race damage frequency BPFI as well as numerous sidebands at intervals of 1X. Rolling element damage The second second second second second Rolling elements rollover frequency BSF with harmonics as well as sidebands in intervals of FTF. Cage damage
D = 3.05 Inch         BPFO = n / $60 \cdot 4,0781 = 12240$ cpm           d = 0.56 Inch         BPFI = n / $60 \cdot 5,922 = 17640$ cpm           Z = 10         2 BSF = n / $60 \cdot 5,239 = 15840$ cpm $\alpha = 0^{\circ}$ FTF = n / $60 \cdot 0,4079 = 1200$ cpm	Cage rotation frequency FTF and harmonics visible
5	Subsequer temperatu
Defective sealing     Ontaminated lubricant used	errating
<ul> <li>BEARING RINGS DEFORM</li> <li>Incorrect installation</li> <li>Wrong bearing storage</li> <li>Shaft manufacturing error</li> <li>Bearing housing overtorqued</li> </ul>	IED Bearing forces on floa • Incorrect installatio • Wrong housing cald • Manufacturing error
• ( + ) • • • • • • • • • • • • • • • • • •	

See our worldwide contacts at www.pruftechnik.com

## ECHNIK —



© PRUFTECHNIK Dieter Busch AG