

ELECTRIC MOTOR DIAGNOSTIC CHART

Cause	Dominant			Comments
	Frequency	Plane	Power Cut	
Misalignment 1.) Bearing 2.) Coupling	Primary 2x Some 1x	Radial & Axial	Drops slowly with speed	1.) 2x can dominate during coastdown 2.) 2x is more prevalent with higher misalignment
	Primary 2x Some 1x	Radial & Axial	Level drops slowly with speed	1.) Parallel causes radial forces and angular causes axial 2.) Bearing misalignment can give rub symptoms
Rub (Seal or bearing)	1/4x, 1/3x, 1/2x or 10-20x can be seen.	Radial	Disappears suddenly as some lower speed	1.) Full rubs tend to be 10-20x higher 2.) Bearing misalignment can give rub symptoms
Rub (Rotor)	1/4x, 1/3x, 1/2x & 1x with slip frequency side bands	Radial		Severe pounding
Looseness 1.) Bearing (non-rotating) 2.) Rotor Core (rotating) 3.) Pedestals (non-rotating) 4.) External fans	2x (3x may be seen)	Radial	Disappears at some lower speed	1.) Bearing seat looseness 2.) Looseness at bearing split
	1-20x with 1,2 & 3 predominant	Radial	1.) Drops with speed 2.) Can disappear suddenly	1.) End plates loose 2.) Core ID loose
	1-10x with 2 & 3 predominant	Radial & Axial		
	1x & 3x	Radial & Axial - ODE	1.) Drops with speed 2.) Can disappear suddenly	
Unbalance rotor	1x rotor speed	Radial	Level drops slowly	Rotor has unbalance - can be due to thermal problems
Bent shaft	2x primary (1x may be seen)	Axial	Level drops slowly	DE runout should give higher 2x axial at that end. Normal runout on core is 1-2 mils.
Eccentric air gap	Strong 120Hz. Some 1x may be seen	Radial	Immediately drops	Air gap ratios from one side to the other. Should be 0.10 or greater Very load sensitive
Eccentric rotor	1x primarily. Some 60 & 120Hz	Radial	Immediately drops	1.) Eccentricity limit 1-2 mils 2.) Load sensitive 3.) Slip beat changes with speed
Rotor Bow (thermal bow)	1x Dominant (120Hz may be seen slip beat)	Radial	Some drop but high level would come down with speed	1.) Heat related 2.) Examine rotor stack for uneven stack tightness or looseness 3.) Shorted rotor iron 4.0 Check bar looseness
Broken rotor bars	1.) Dependent upon no. of broken bars 2.) 1x with twice slip side bands 3.) High stator-rotor slot frequencies	Radial	Immediately drops	1.) Sparking in the air gap may be seen 2.) Long term variation in slot frequencies can be indicator of bar problems 3.) Broken bars cause holes in the magnetic field 4.) Large current fluctuations 5.) Current analysis shows slip frequency side bands
Loose bars	1.) Stator & rotor slot frequency 2.) Possible balance effect with thermal sensitivity 3.) Stator slot frequency plus side bands @ $\pm (Ns-Nr)$	1.) Considerable variation 2.) 0.1 ips at idle may be questionable 3.) Monitor change with time 4.) Amplitude pulsates at slip RPM x # of poles	1.) Immediately disappears 2.) Load sensitive 3.) Imbalance effect can suddenly disappear at some lower space 4.) Immediately disappears	1.) Average data required because of variation 2.) Note that these frequencies vary normally by a factor of 2-3 free idle to full load 3.) Excessive looseness can cause balance problems in high speed motors.
Unbalanced line voltages	120Hz	Steady 120Hz & possible beat	Immediately disappears	
Electrical noise vibration	(RPM x # of rotor slots) / 60 +/- 120, 240 etc.	Steady	Immediately disappears	
Oil film instability (Oil whirl)	Approx. 1/2 rotational (.43 - .48)	Steady		
Anti Friction Bearing Problems.		Steady		
Resonant Parts		Steady	Drops rapidly	May be adjacent parts