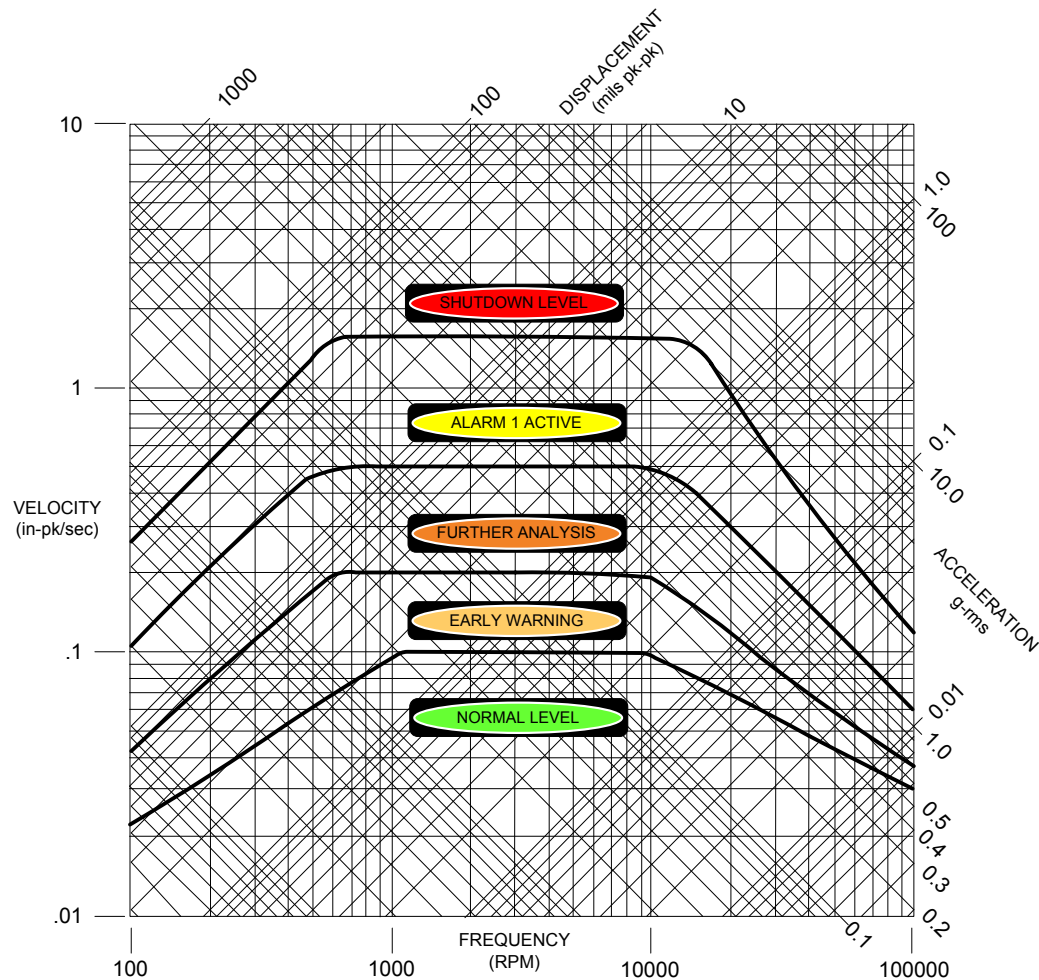


Machinery fault analysis guide



Instructions:

1. Locate machine rotational speed on frequency scale.
2. Record the velocity (in-pk/sec or vdB) OR displacement (mils pk-pk) OR acceleration (g-rms), and if applicable multiply the reading by the Service Factor listed in Table 1.
3. Locate the adjusted reading on the appropriate scale on the chart above. The intersection of 1 and 2 determines machine condition.
4. See guide on page 2 for troubleshooting.

Table 1: Service factors

Machinery type	Service factor
Single stage centrifugal pump, electric motor, fan	1.0
Non-critical chemical processing equipment	1.0
Turbine, turbine generator, centrifugal compressor	1.6
Centrifuge, shaft suspended	0.5
Centrifuge, link suspended	0.3
Miscellaneous equipment with unknown characteristics	2.0

Troubleshooting machinery faults and unusual vibration readings

Type of machine or device	Frequency of disturbance	Plane of vibration	Other related symptoms	Possible causes	Notes	Indicated level for possible trouble (in-pk/sec)
Rotating motors, generators	1x base RPM	Radial	Steady or increase with rotational speed	Rotor unbalance	Common problem: check dynamic balance of main motion	0.2 - 0.05 106 - 115 vdB
Electric motor	7200 RPM	Radial	Stops when power to motor is cut	Armature lamination chatter	Armature requires repair	0.1 - 0.5 100 - 115 vdB
Electric motor	Erratic	Axial	Unsteady vibration reading	Motor misalignment	Check alignment and leveling	Unsteady
Rotating - 2 or more units	Very low	Radial, depends on mounting form	Level may vary and exhibit beat characteristics	Interaction due to non-synchronous operation of 2 units very close in rotational frequency	Isolate and dampen sources	0.05 - 0.2 98 - 105 vdB
Couplings, shafts and bearings	2x base RPM, sometimes 1x or 3x	Usually axial, sometimes radial	High operating temperatures, noise	Misaligned couplings or shaft bearings	Check alignment tolerances. If shaft is bent, vibration will be at base speed	0.2 - 0.05 106 - 115 vdB
Sleeve bearings	50-100x RPM	Radial	Random in nature, energy distributed over wide frequency range. May excite critical shaft resonance 1x or 2x RPM, may get hot	Defective bearings, excessive friction	Replace	0.05 - 0.2 98 - 105 vdB
Sleeve bearings	1/2 base RPM	Radial	Disappears when speed drops	Oil whirl in lubricated bearings	Check for excessive clearance or insufficient bearing loads	0.05 - 0.2 98 - 105 vdB
Sleeve bearings	Armature resonance	Radial	Does not vary with speed	Friction whip; excessive friction rubbing or chatter in bearing excites armature or support	Replace bearing or improve lubrication	0.1 - 0.5 100 - 115 vdB
Ball bearings	Sometimes high multiple of base RPM	Radial	Readings may be unsteady. Spikes indicate pitted balls	Worn balls; rough races; poor lubrication	Check, lubricate or replace bearings	0.1 - 0.5 100 - 115 vdB erratic
Gears	1x RPM of: (number of teeth × RPM or gear ratio)	Radial or torsional	May excite structure resonance	Chipped gear; eccentric gear path circle	Inspect gear; replace or correct eccentricity	0.1 - 0.5 109 - 115 vdB
Belts	1x base RPM	Axial and radial	Readings may be unsteady	Belts misaligned, mismatched or in resonance	Check alignment, dampen vibration or replace belts	0.1 - 0.5 98 - 110 vdB
Fans and impellers	1x base RPM or blade passing frequency	Axial or radial	Frequency will vary with speed	May be design or proximity problem	Relocate, change blade distance, clean blades, check for imbalance	0.1 - 0.5 98 - 110 vdB