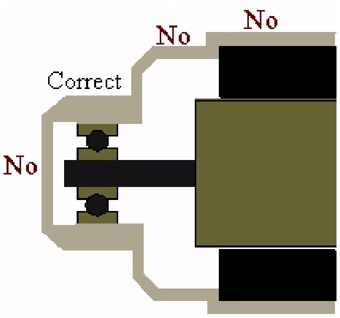
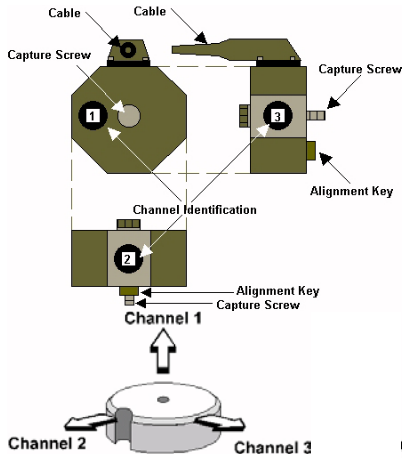
Vibration Diagnostic Guide



Accelerometer Location

Selecting Test Locations

1. Transmission Path
2. Frequency Response
3. Repeatability

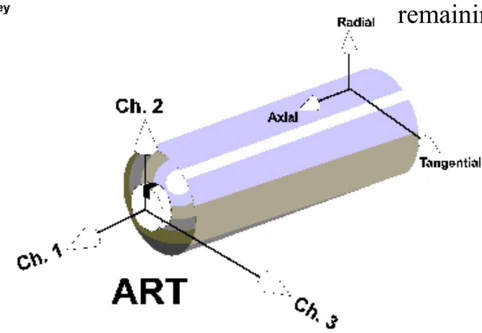


Sensor attachment pad

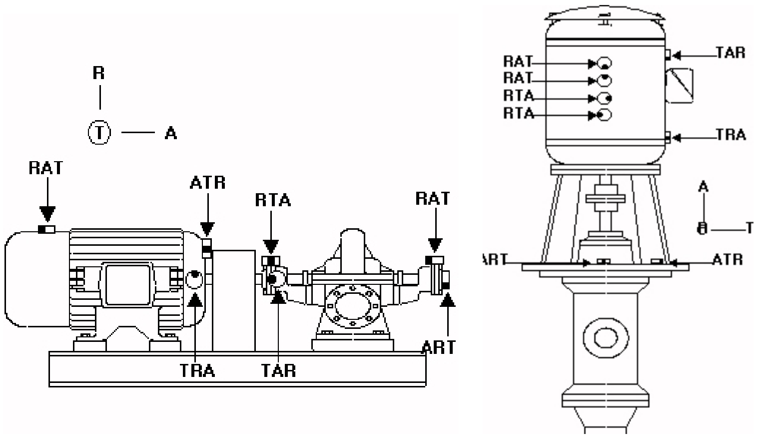
Selecting Orientations

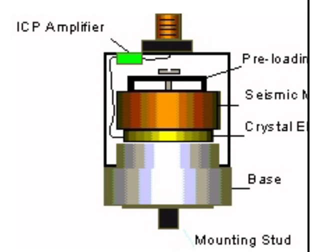
<u>1-2-3</u>   <u>1-2-3</u>
R A T : V A H
A R T : A V H
T R A : H V A

- Sensor #1 is in line with captive screw
- Sensor #2 is in line with alignment pin
- Sensor #3 is in the remaining plane

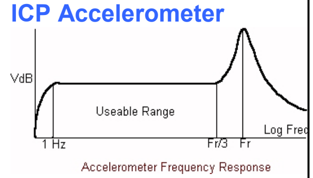


Horizontal shaft and Vertical shaft Orientations





ICP Accelerometer



Frequency Response

Maintenance Types:

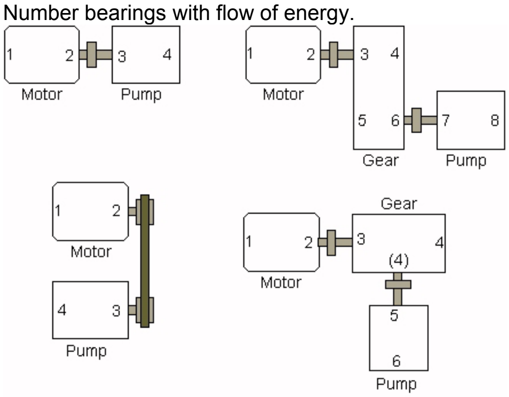
Reactive – Run to Failure
Preventive – Calendar based
Predictive – Condition based
Proactive – Root Cause Analysis

Keys to a Successful Program:

- Complete & repeatable data
- Get Answers, not just Data
- First rate support & training
- Distribute information to planners and managers

Sensor Location Numbering

Start numbering from driver free end.
Number bearings with flow of energy.



Sensor Location Numbering

Maintenance Planning

<u>Extreme Faults</u> – Shutdown machine for immediate repairs to avoid catastrophic failure
<u>Serious Faults</u> – Schedule normal repairs for planned outage or maintenance period
<u>Moderate Faults</u> – Increase frequency of collection / Review parts availability
<u>Slight Faults</u> – Monitor machine
Retest following maintenance – Verify maintenance performed correctly

Vibration Severity Considerations

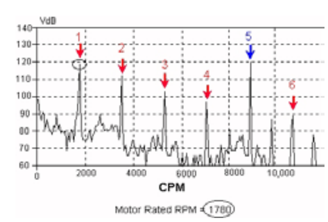
Harmonics – fault getting worse; looseness
Side-bands – modulation by another signal
Elevated noise floor – increase in background
Multiple symptoms – confirming evidence

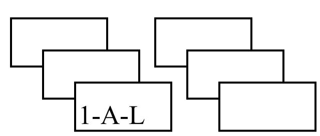
Sidebands in machine data

Roller bearing – 1X sidebands
Gear wear – 1X sidebands
Motor Bars – 120 Hz sidebands

Analyze Data

1. Find 1X peak and harmonics
2. Identify forcing frequencies
3. Identify machine faults – Imbalance, Misalignment, Bearings, Looseness
4. Compare data between axis / ranges
5. Compare data to baseline
6. Compare data to other like machines
7. Compare data to previous data





Vibration Diagnostic Guide

VdB to IPS

VdB	ips peak	VdB	ips peak	VdB	ips peak
60	.0006	90	.018	120	.56
62	.0007	92	.022	122	.70
64	.0009	94	.028	124	.88
66	.0011	96	.035	126	1.1
68	.0014	98	.044	128	1.4
70	.0018	100	.056	130	1.8
72	.0022	102	.070	132	2.2
74	.0028	104	.088	134	2.8
76	.0035	106	.11	136	3.5
78	.0044	108	.14	138	4.4
80	.0056	110	.18	140	5.6
82	.0070	112	.22	142	7.0
84	.0088	114	.28	144	8.8
86	.011	116	.35	146	11.1
88	.014	118	.44	148	14.0

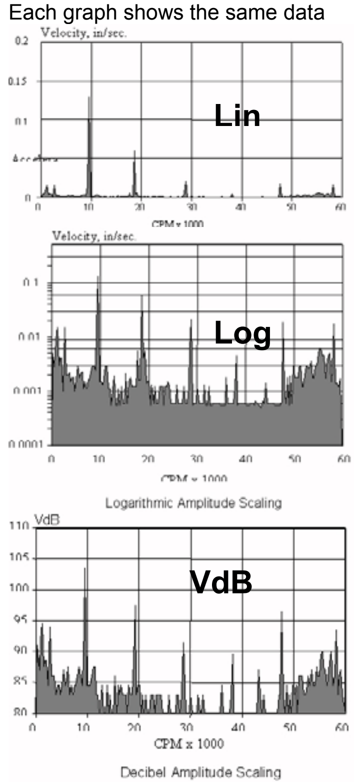
Log to Linear

dB Change	Linear Level Ratio
0	1
3	1.4
6	2
10	3.1
12	4
18	8
20	10

Analyze data with all of the tools available. Get familiar with both linear and log amplitude scales to optimize analysis. Use both CPM and Order Normalized frequency analysis

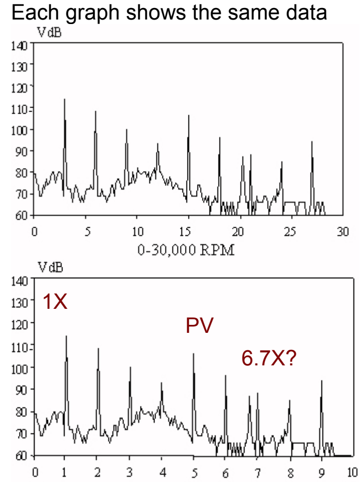
Amplitude levels –

Each graph shows the same data



Frequency Analysis – CPM vs. Orders

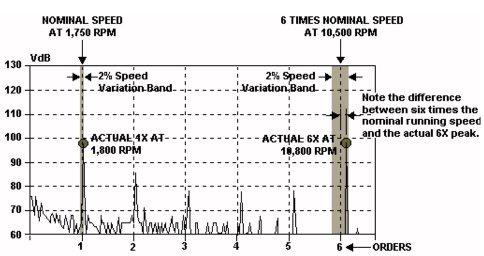
Each graph shows the same data



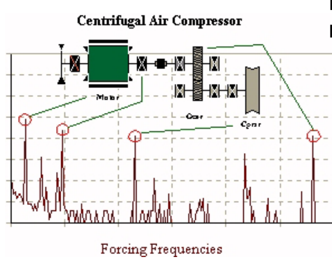
Order Normalized data is easier to quickly identify shaft vibration and components associated with shaft

Log data allows viewing small peaks and large peaks on the same graph without rescaling of data. VdB scaling eliminates decimals.

Fine-tune Program

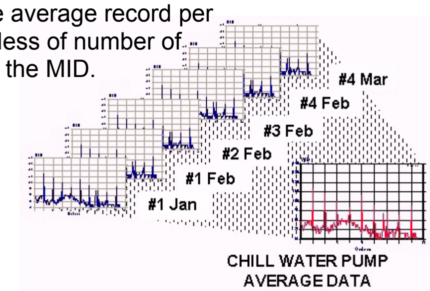


1. Reset speed (Normalize data)



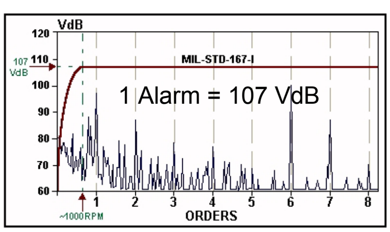
2. Find Forcing Frequencies

There is one average record per MID, regardless of number of machines in the MID.

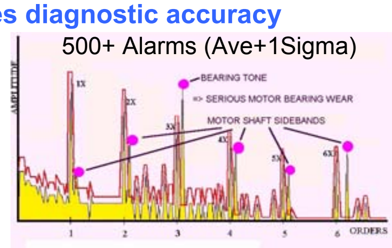


3. Select good data for Averages

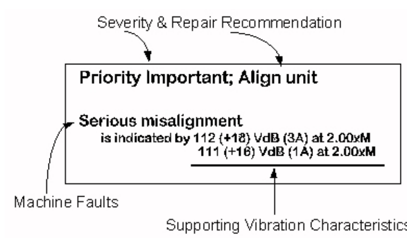
More Averages in Basline increases diagnostic accuracy



No Averages – Mil Std 167-1

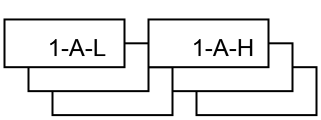


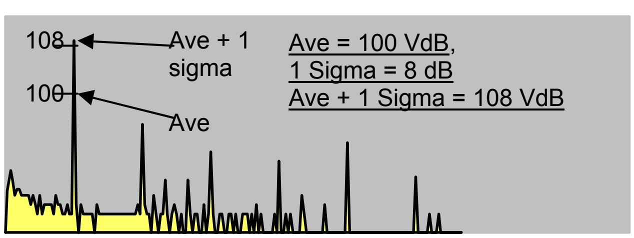
5-24 Averages of healthy machine data



Diagnostic Report

Each MID file contains the 'average + 1 sigma' data for each position, axis and range





6 Healthy sets of data, 1X spectral peak =

1-104 VdB   4-100 VdB
2-102 VdB   5-98 VdB
3-100 VdB   6-96 VdB