

Fermi National Accelerator Laboratory

FERMILAB-TM-1931

Screw Compressor Bearing Failure at C0#4

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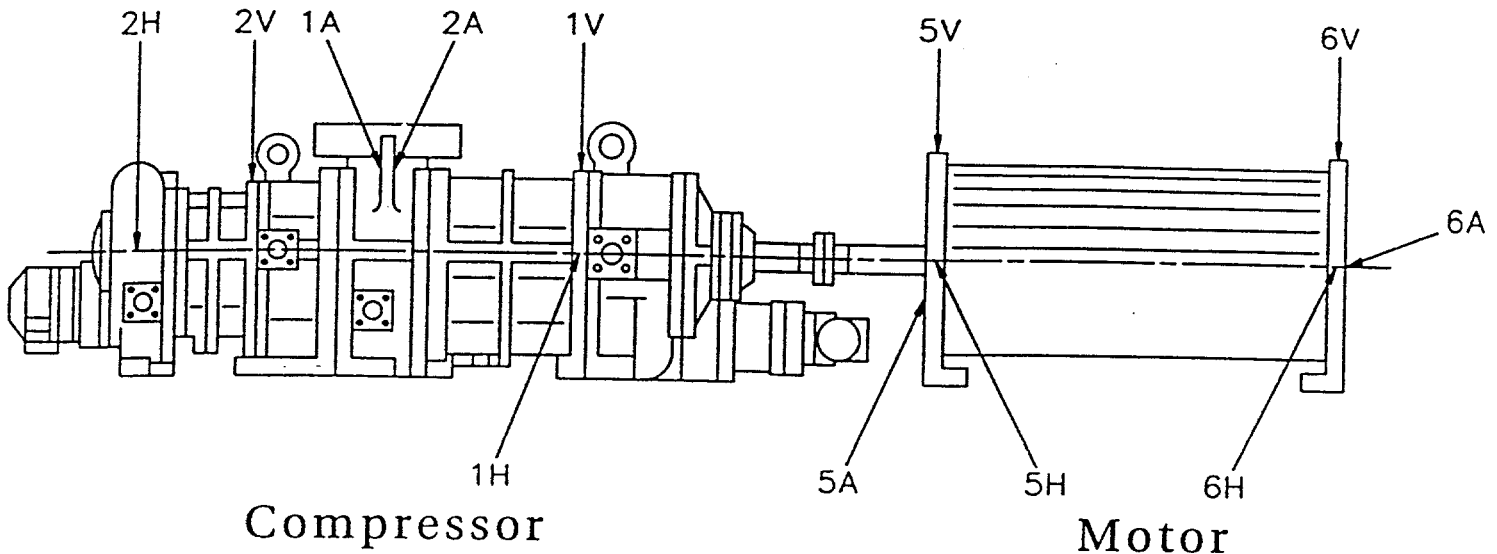


SCREW COMPRESSOR BEARING FAILURE AT C0#4

Carl Pallaver/Terry Cross

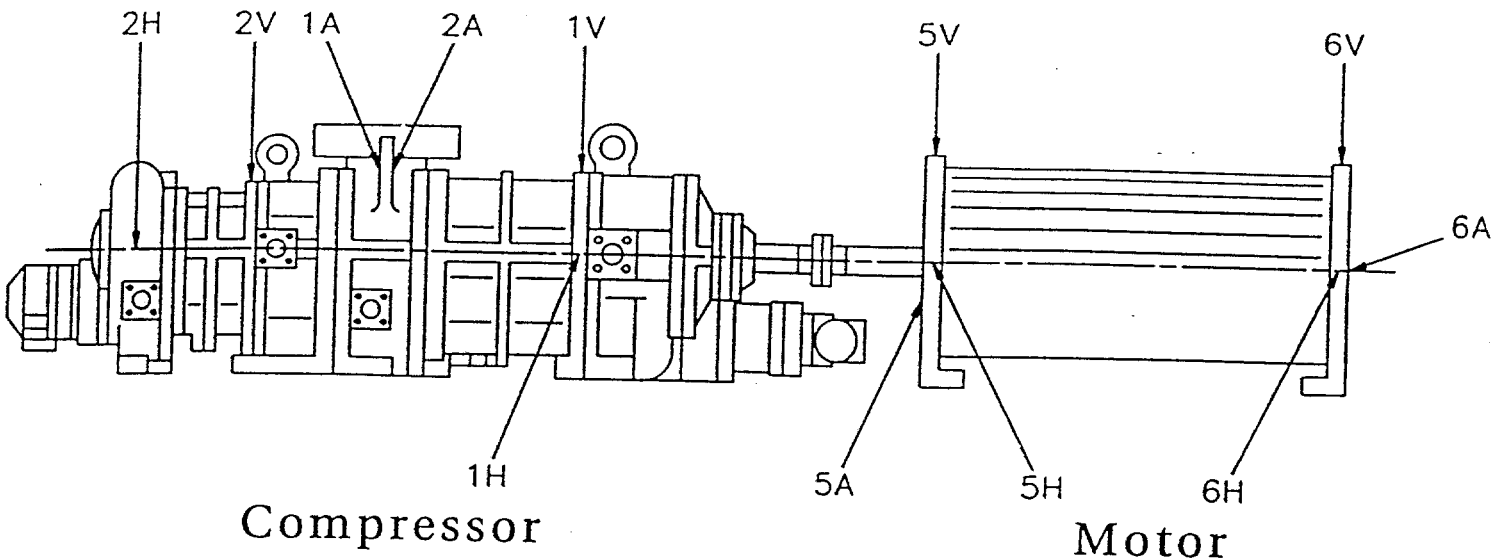
All our compressors operate unattended. The only mechanical failure indicator is a shaft probe on the second stage rotor drive. When movement of the thrust bearing occurs contact is made between the second stage rotor and the shaft probe completing a circuit and subsequently tripping off the compressor. This device is set at 0.004 to 0.006 inches. Should this probe circuit fail and a bearing failure occur, the rotors would eventually strike the interior casing causing a high horse power alarm to register in the main control room.

Compressor C0 #4 adjoins our service building and has thermocouples on each thrust bearing outer race, total of 4. These temperatures are read continuously and registered on a chart recorder. On December 21, 1994 at 1000 hours we observed an increase in noise level on this machine with 35,000 registered operating hours. There are 3 other compressors in this building which mask out most noise and makes it difficult to pin point the problem. At 1500 hours we took spike energy and amplitude readings on all four machines within the building. The results are shown below.



12/21/94	Spike Energy	Spike Energy	Amplitude
Compr.	Position 1A	Position 2A	Position 2A
C0#1	0.17	0.15	0.08
C0#2	0.13	0.10	0.09
C0#3	0.14	0.10	0.08
C0#4	0.38	0.41	0.10

On December 22 at 0400 (13 hours later) the shaft probe shut C0 #4 compressor down. At 1000 hours we cleared the control panel and started the machine. The position 1A spike energy read 12.0, amplitude 0.09, the shaft probe shut the machine down within 5 minutes. At 1300 we cleared the control panel and started the machine again. Within a minute, the shaft probe shut the machine down. This machine was replaced. Our inspection of the noisy machine confirmed a bad 2nd stage thrust bearing.



Compr. 12/22/94	Spike Energy	Amplitude	Ultrasonic Freq.	Machine
	Position 2A	Position 2A	Position 2A	
C0#1		0.10	4.96	Fully Loaded
C0#2		0.10	4.83	Fully Loaded
C0#3		0.04	5.18	Fully Loaded
C0#4	1.20	0.12	2.94	Fully Loaded
C0#4	1.20	0.12	3.54	Unloaded

Conclusions

During this thrust bearing failure we registered a rise of 2 to 3 degrees Fahrenheit, insufficient for an alarm or shut down protection. Our monthly amplitude readings do not have the sensitivity to detect bearing deterioration.

Spike energy readings have the sensitivity required for early detection of bearing failure and ultrasonic measuring of bearings may be a better method for our monthly readings.

Instruments

*Spike Energy JRD Corp. Model 820
Gravity units, amplitude scale of 10*

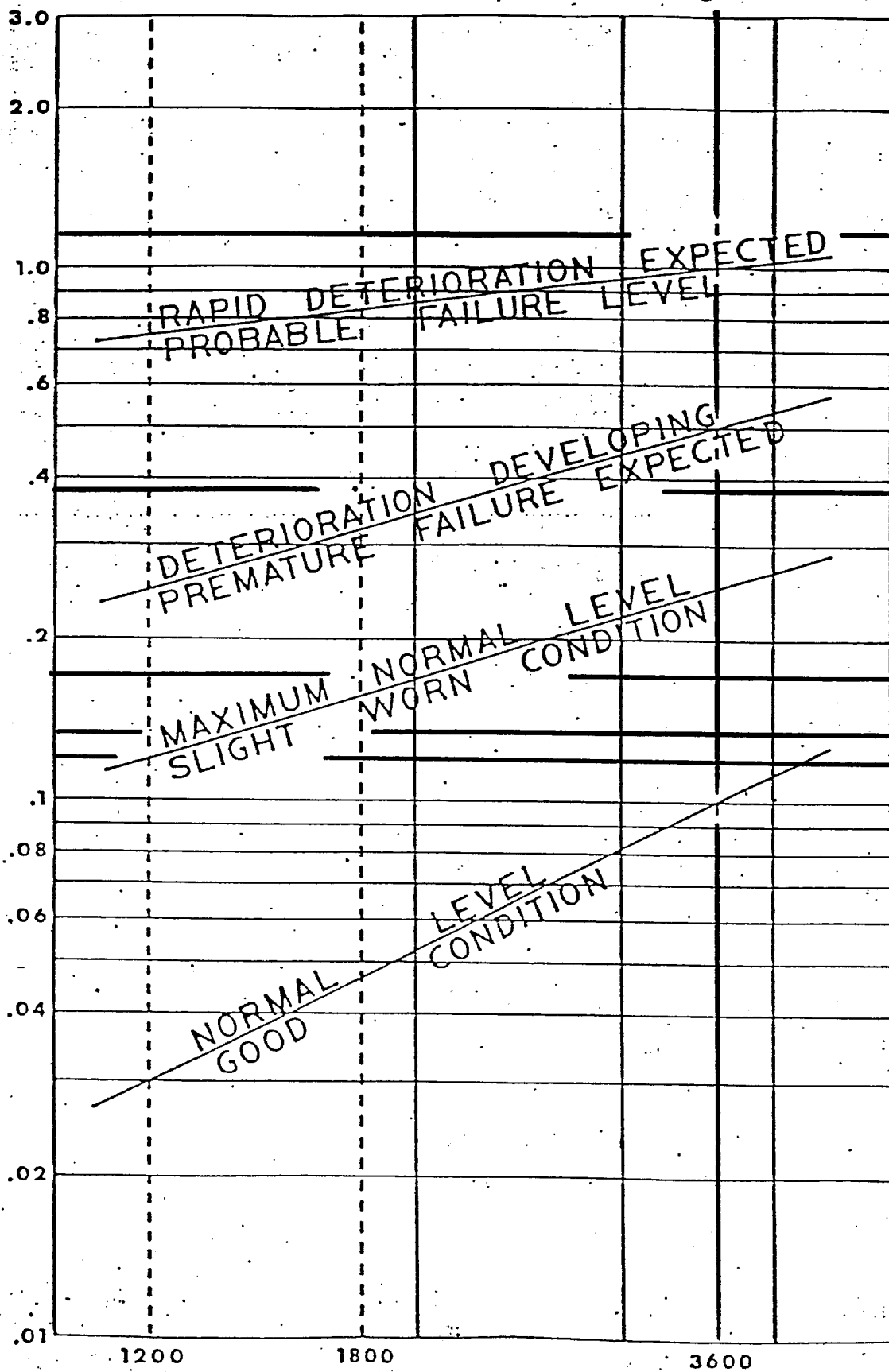
*Amplitude JRD Corp. Model 808
Velocity in inches per second peak to peak*

*Frequency Monitor UE Systems Model 2000
Ultrasound*

ANTIFRICTION BEARING (g-SE) SEVERITY GUIDE

BY D.R. WRIGHT

SPIKE ENERGY ACCELERATION (g-SE)



SHAFT RPM * TYPICAL
MACHINES