



# Field Services Report:

## **Vibration Analysis and Alignment Check from Pump and Motor**

### Abstract

WARMAK Inc. was commissioned to observe the vibration and check the alignment from a main pump. The motor was observed to have an audible surge. The shaft appeared to be moving in and out axially at the coupling. The alignment was within 0.001 inch in the vertical direction and 0.015 inch in the horizontal direction. Angularity in both directions was 0.0001-0.0002 inch/inch. The main cause of vibration is probably from electrical rotor/stator problems in the motor. The motor should be tested and repaired. Defects of this kind can cause serious damage if left to follow their natural course.

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## Scope

Provide equipment and labor to measure and analyze the vibration and observe the alignment from a motor to a pump.

## Background

Plant personnel stated that the motor had been reworked and rewound to provide more Hp than original and bearing temperatures were higher than expected. Name plate rework date: 11/15/01.

## Machine Configuration

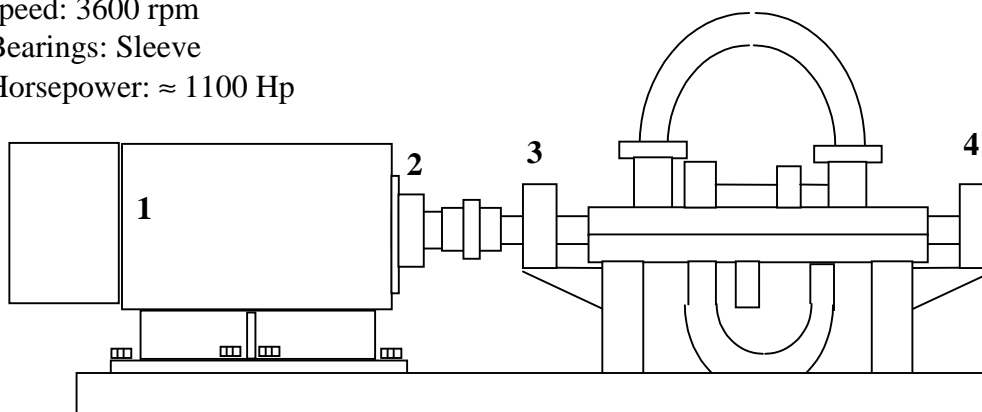
Foundation Type: Concrete

Pump Type: Centrifugal multi stage

Pump Speed: 3600 rpm

Motor Bearings: Sleeve

Motor Horsepower:  $\approx$  1100 Hp



## Procedure

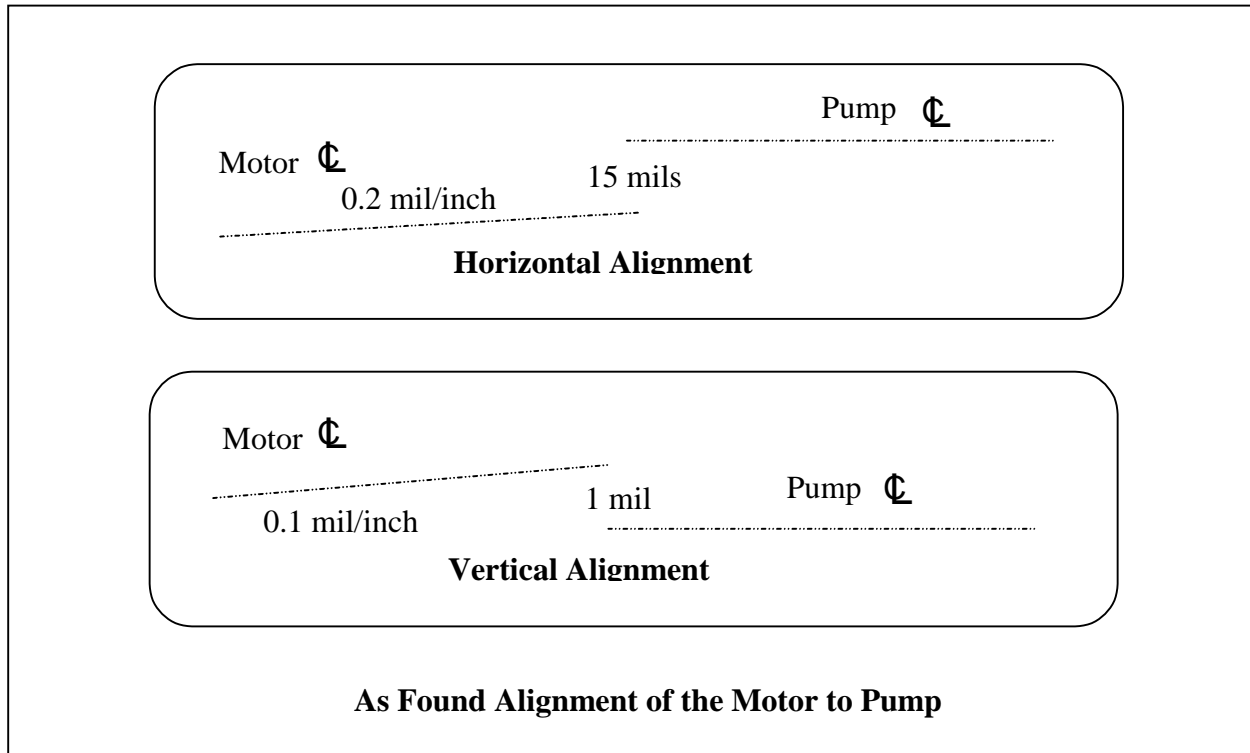
Background and ideas were discussed with plant personnel. One of the sister units was brought down and the unit in question was started and brought on line. The unit was allowed to operate until nominal temperature were achieved (30 min). Vibration was monitored periodically during this time.

After the motor bearing temp reached about 150° F as observed from the embedded RTD sensor, vibration data was collected from the four locations in the drawing above. Horizontal, vertical and axial directions were used and several different configurations of the data collector.

After the vibration data was collected the machine tripped out. The breaker was racked out and locked. The alignment was measured using LASER methods.

Results and recommendations were discussed with plant personnel.

## Alignment Results

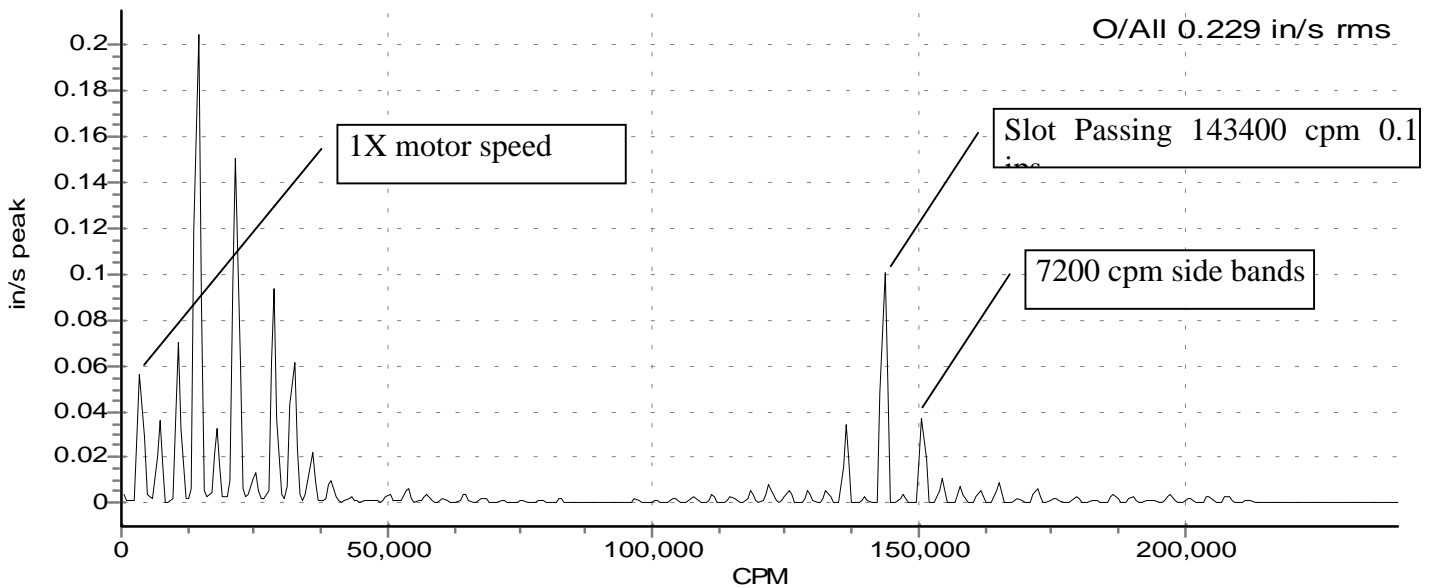


## Vibration Results

Peak Vibration(inches/second) and Frequency (cycles/minute)

Position	Amplitude	Frequency	Date	Machine
1H	0.281	3600	02.01.22	motor
1V	0.043	17955	02.01.22	motor
1A	0.077	3600	02.01.22	motor
2H	0.134	14355	02.01.22	motor
2V	0.116	3600	02.01.22	motor
2A	0.152	14355	02.01.22	motor
3H	0.172	3600	02.01.22	pump
3V	0.051	14355	02.01.22	pump
3A	0.046	3600	02.01.22	pump
4H	0.26	3600	02.01.22	pump
4V	0.034	10755	02.01.22	pump
4A	0.066	3600	02.01.22	pump

PP020122 - 123A - 2 - Horizontal - Vel Freq 240000 CPM  
1/22/2002 11:06:03 AM



The above spectrum shows that the slot passing vibration is greater in amplitude than the operating speed and that the 4<sup>th</sup> order harmonic is the highest peak. Typically there should be some slot passing vibration but not greater in amplitude than the operating speed vibration. The side bands at 2X line frequency should be very low. This demonstrates there is an electrical problem with the motor.

## Comments

Some higher than expected vibration at 3600 cpm in the horizontal direction was observed from the pump. This is probably due to the misalignment and vibration from the motor being transmitted across the coupling.

The vertical alignment is excellent. The horizontal alignment should be corrected for offset the angularity is excellent.

If the motor is going to be shimmed under the corner feet only instead of full length then the center two bolts should be removed. It was observed that the holes for mounting were elongated. Plates should be made to provide even clamping on the feet. Small washers that deform into the holes will allow the motor to shift position during operation.

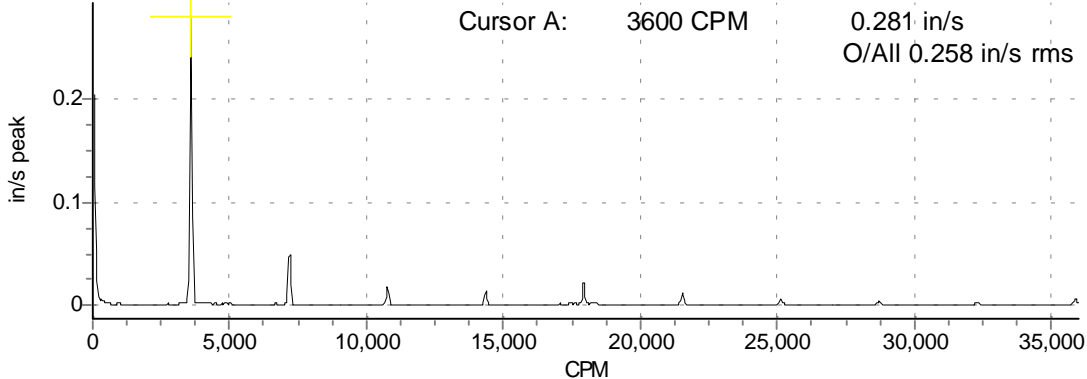
The motor should be tested and evaluated for broken or cracked rotor bars and shorted windings. Broken rotor bar problems are load and heat dependent. The motor should be tested under load and allowed to reach normal operating temperature.

Maintaining magnetic center is mandatory on sleeve motors and care should be taken to insure proper axial placement. Sometimes strong axial forces can be created by the cooling fan.

## Appendix A (Vibration Data)

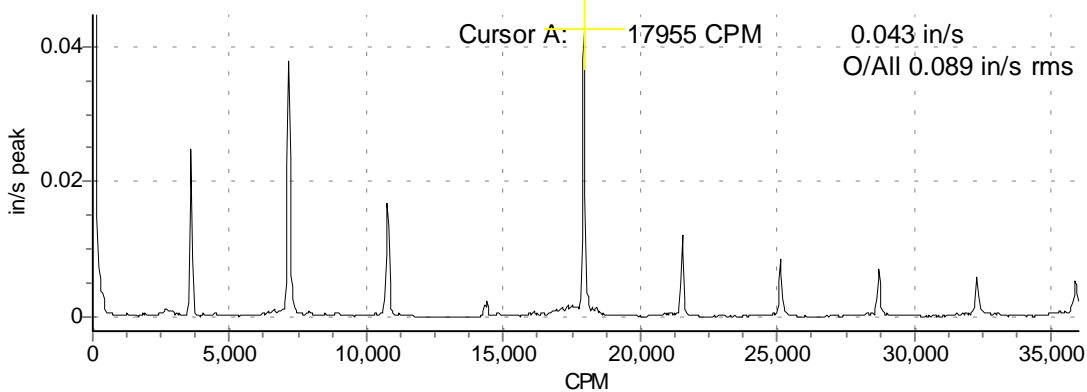
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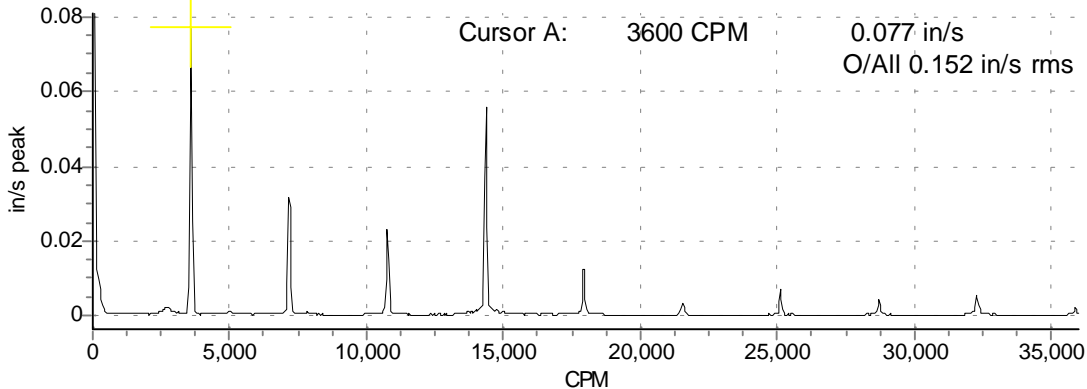
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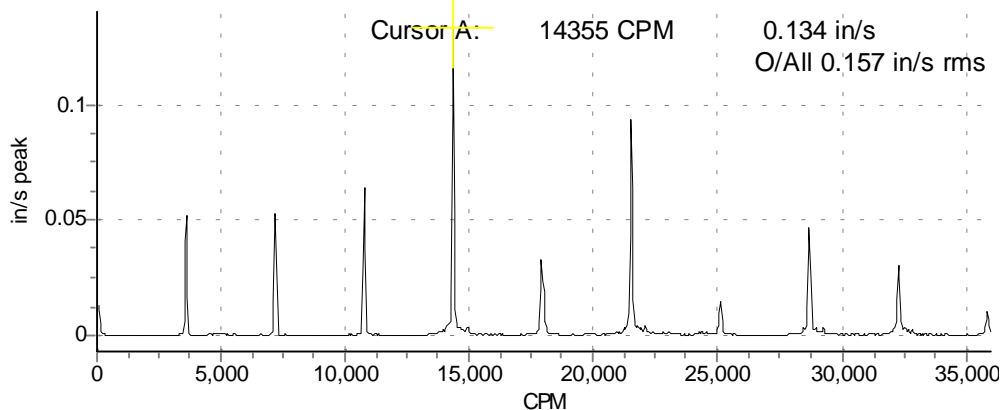


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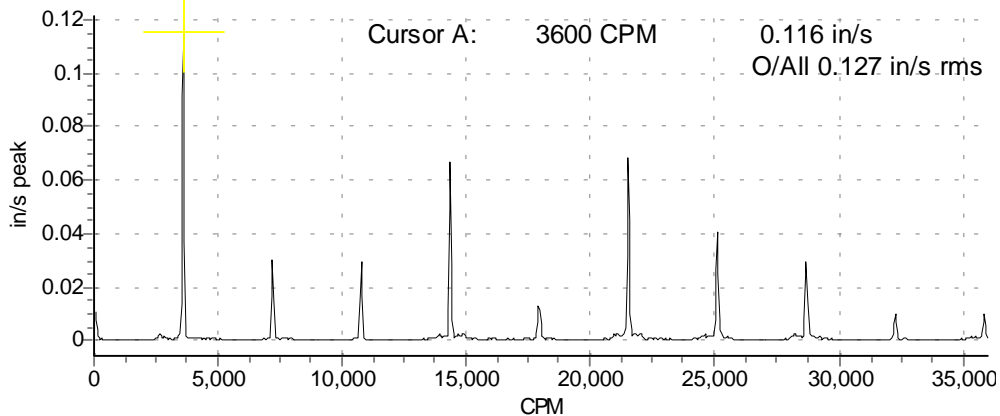
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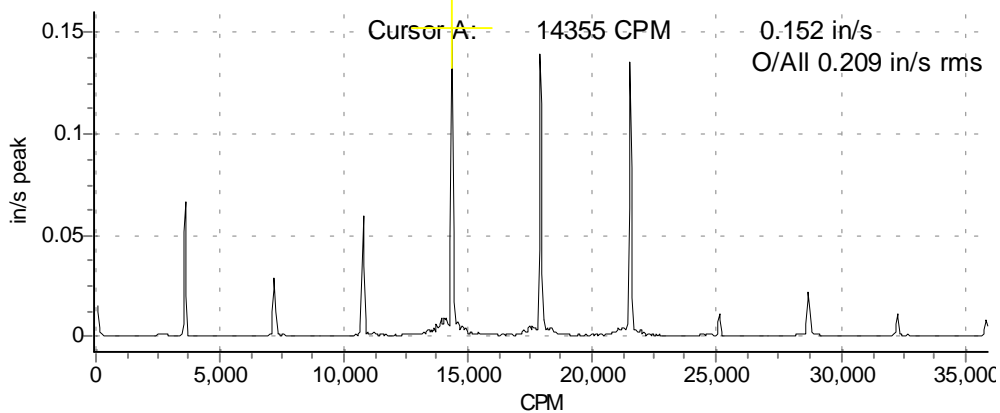
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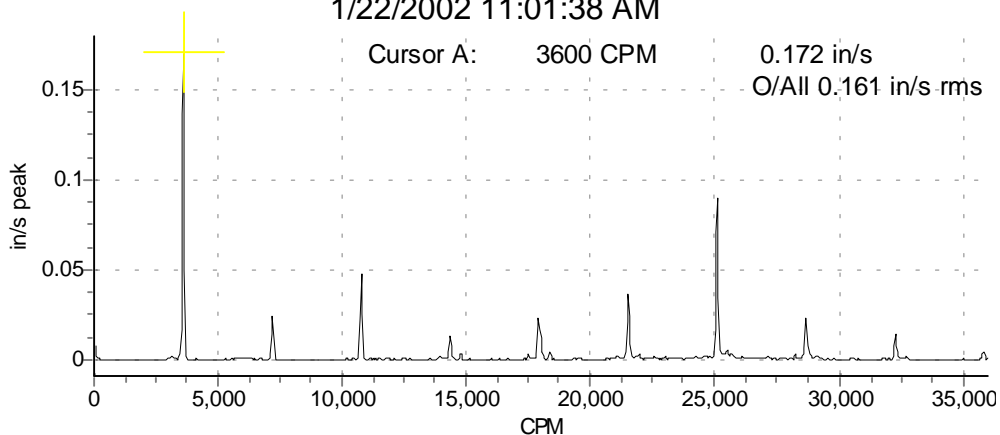
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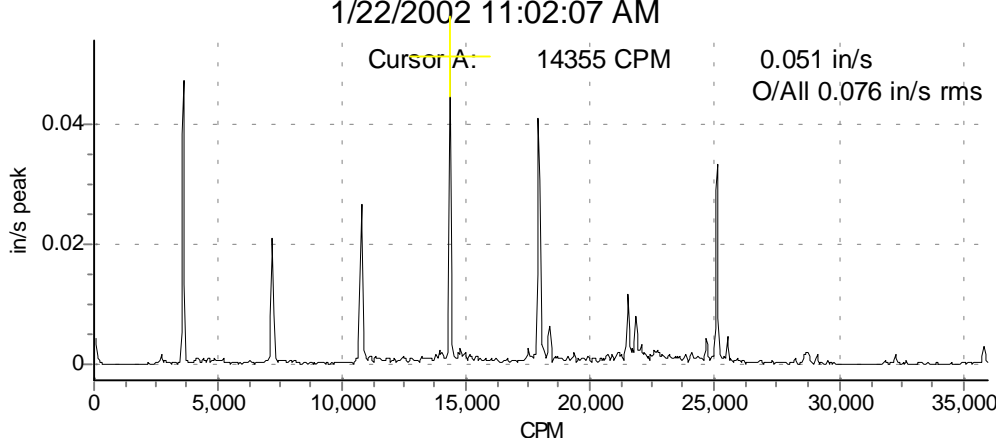
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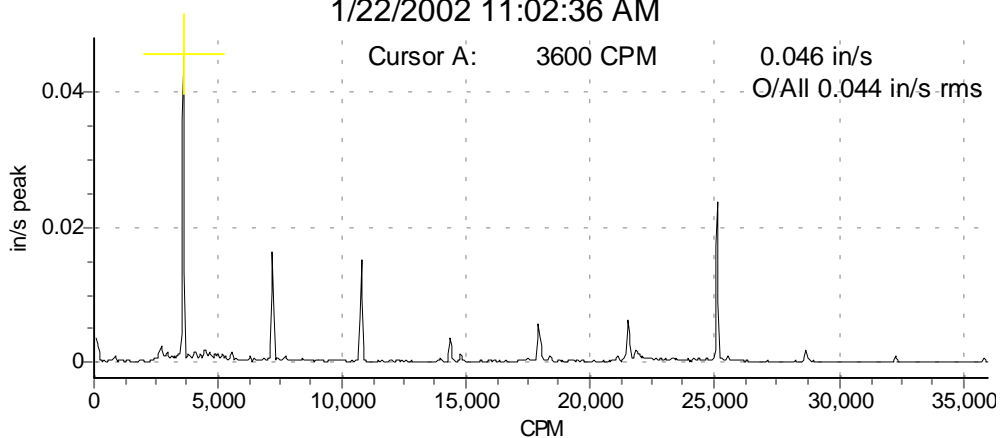
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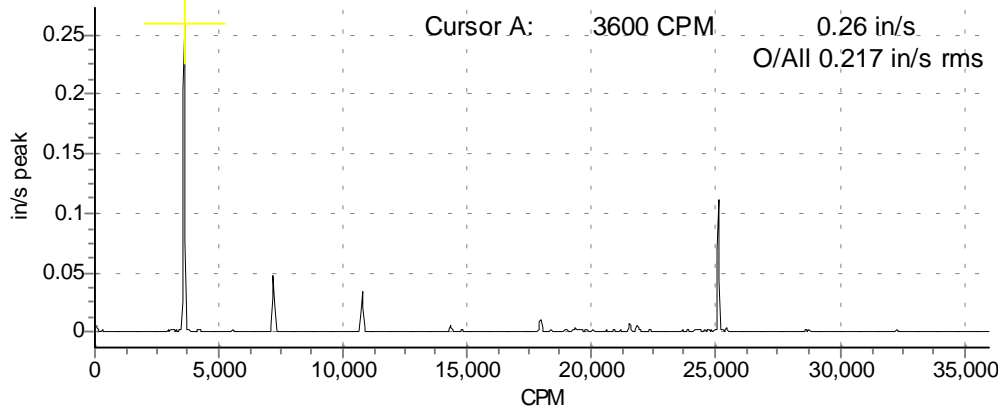
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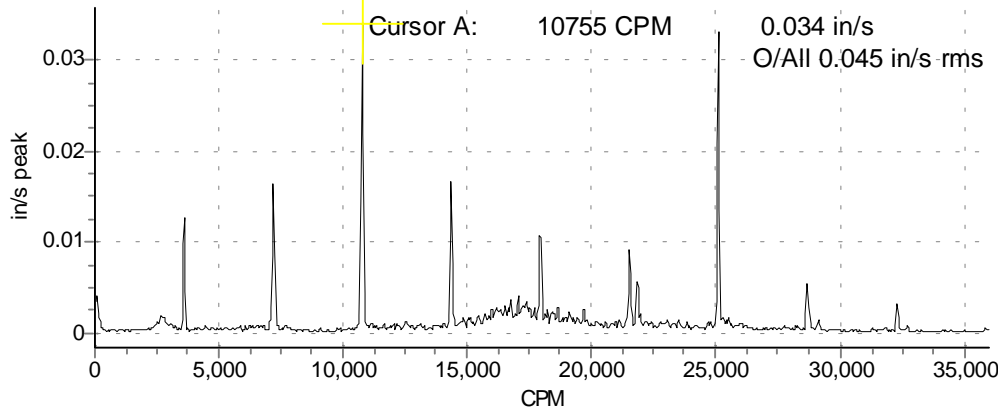
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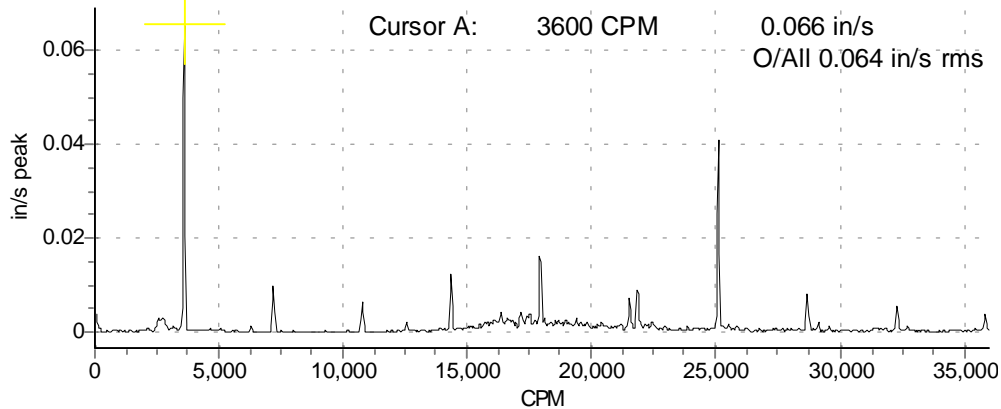
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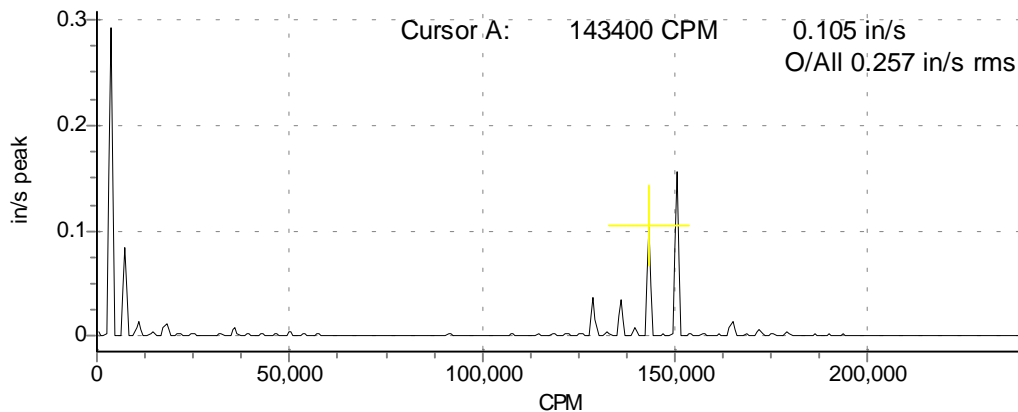
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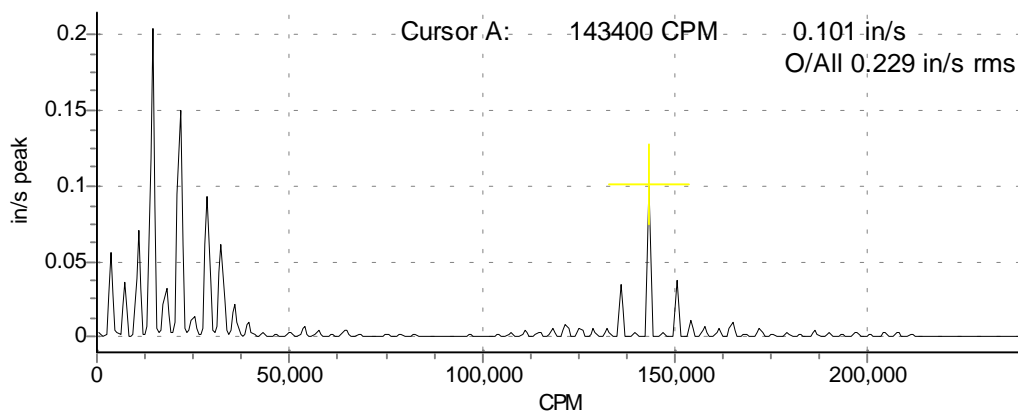
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PP020122 - 123A - 1 - Horizontal - Vel Freq 240000 CPM  
1/22/2002 11:06:39 AM



PP020122 - 123A - 2 - Horizontal - Vel Freq 240000 CPM  
1/22/2002 11:06:03 AM



PP020122 - 123A - 2 - Horizontal - Vel Time 160 ms  
1/22/2002 11:25:29 AM

