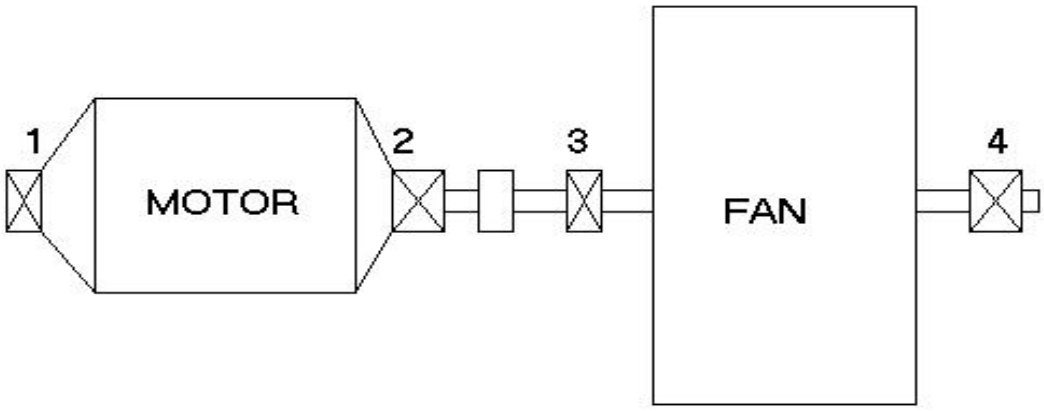
Problem:

Our client was experiencing excessive vibration on one of the Boiler Forced Draft Fans in their power house. We were asked to come on site to diagnose and fix the problem

Picture/Sketch:



Personnel Interviews/Machine History:

Maintenance Manager: "We really have not done much to the unit but we have been noticing the vibration has begun to grow over the last few months."

"We had the fan bearings replaced within the past year."

Machinery Information:

Motor/Fan RPM: **1200**
Motor HP: **600**
Motor/Fan Bearing Type: **Roller**

Inspection:

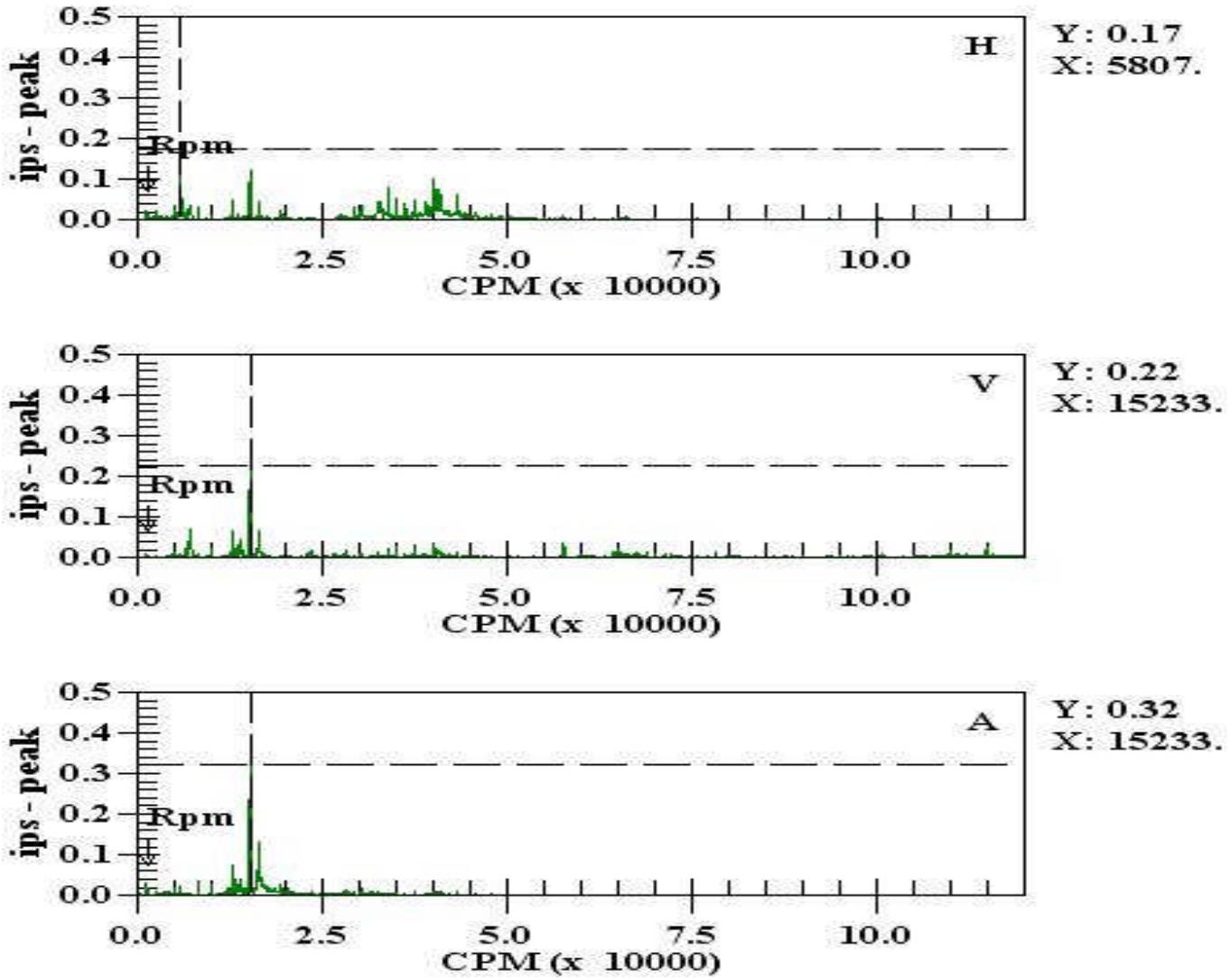
Our field service technician first conducted a visual inspection of the entire machine and its foundation. The inspection of the fan revealed no problems: no cracks, bolts were tight, and the bearings were not over greased.

Data:

Our personnel collected vibration spectral data on all the machine bearings to identify any fault frequencies. The motor data revealed strong broadband energy in all the spectra. We also found that the highest peaks were not at whole multiples of the motor's operating speed.

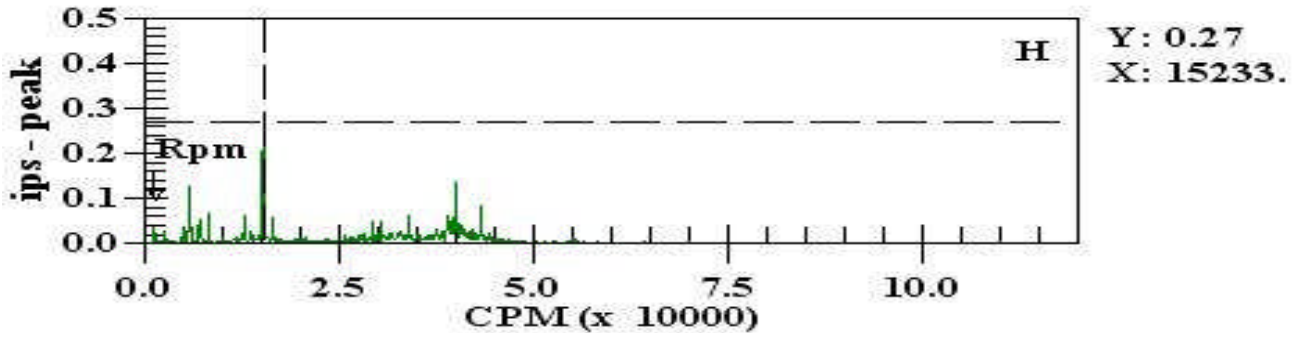
AS FOUND

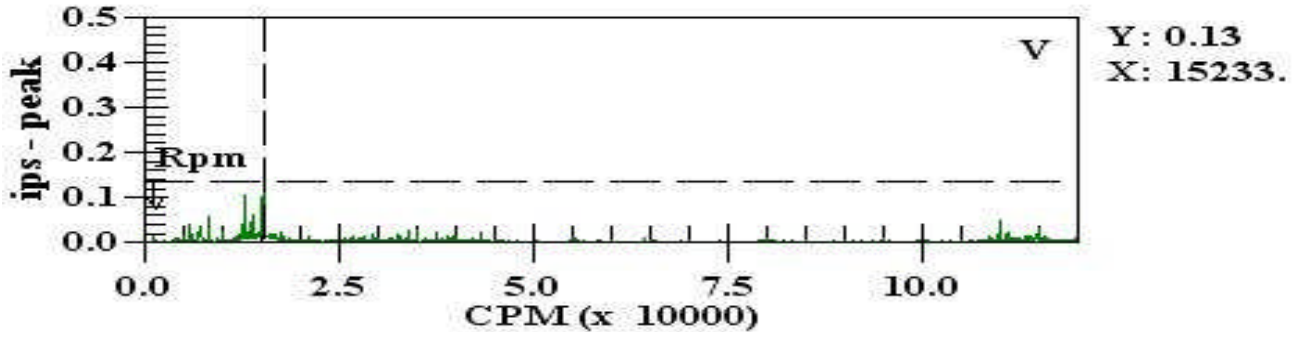
OB MOTOR

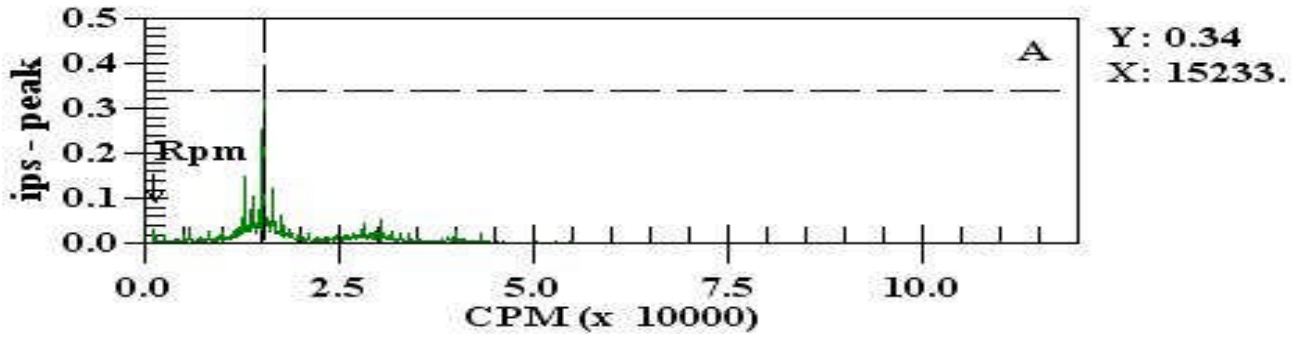


AS FOUND

IB MOTOR

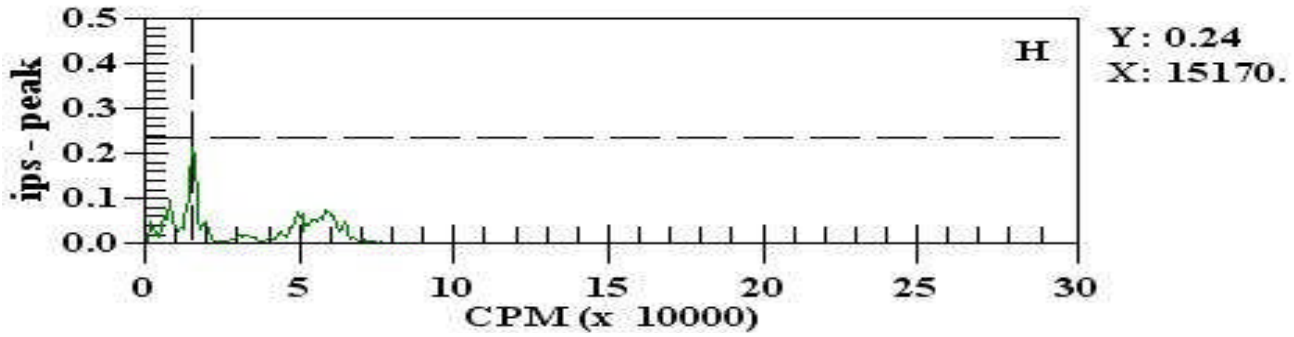


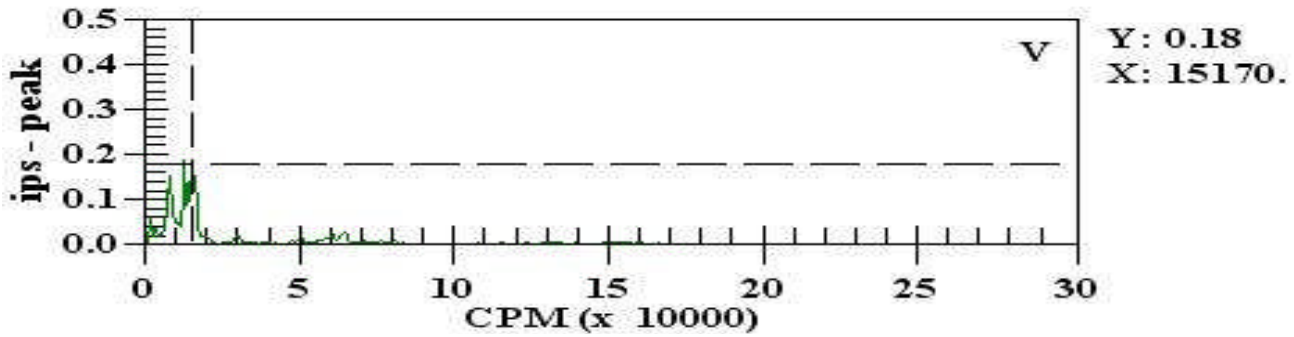


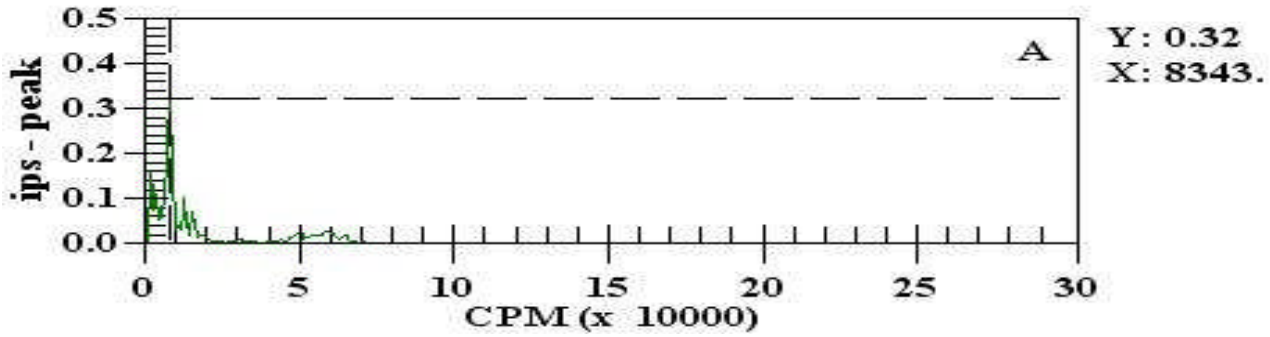


AS FOUND

IB FAN

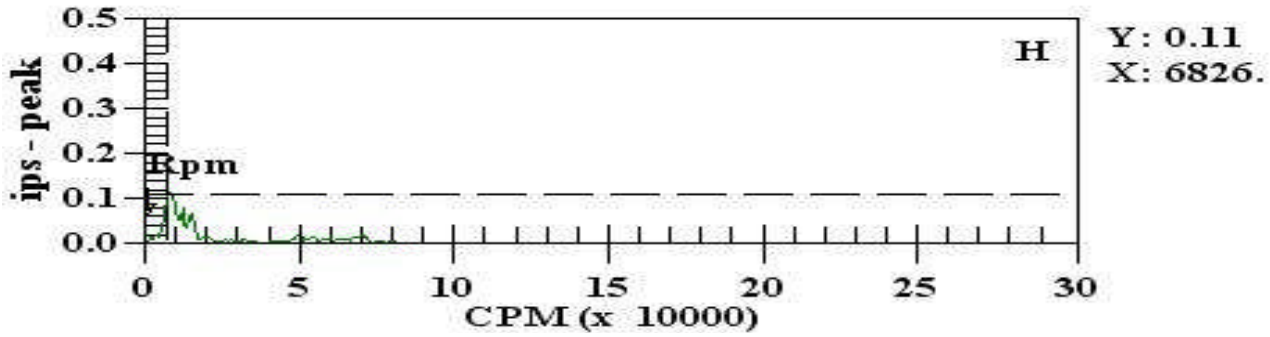


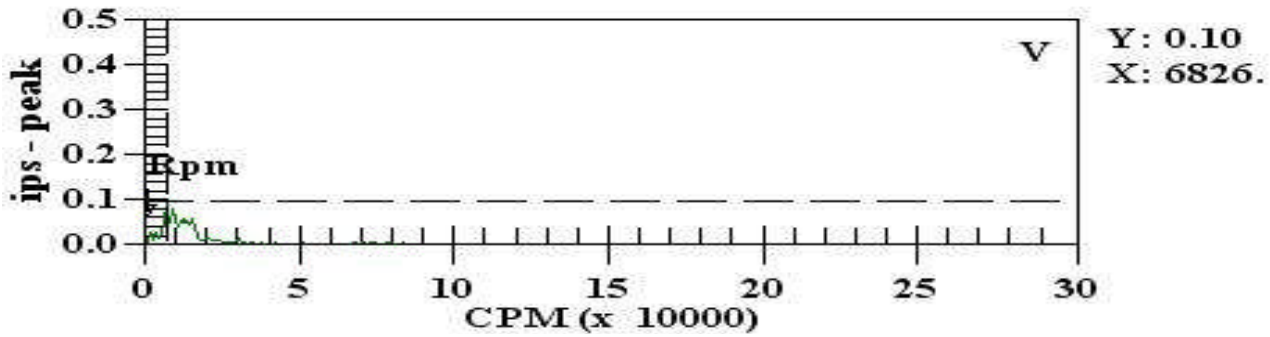


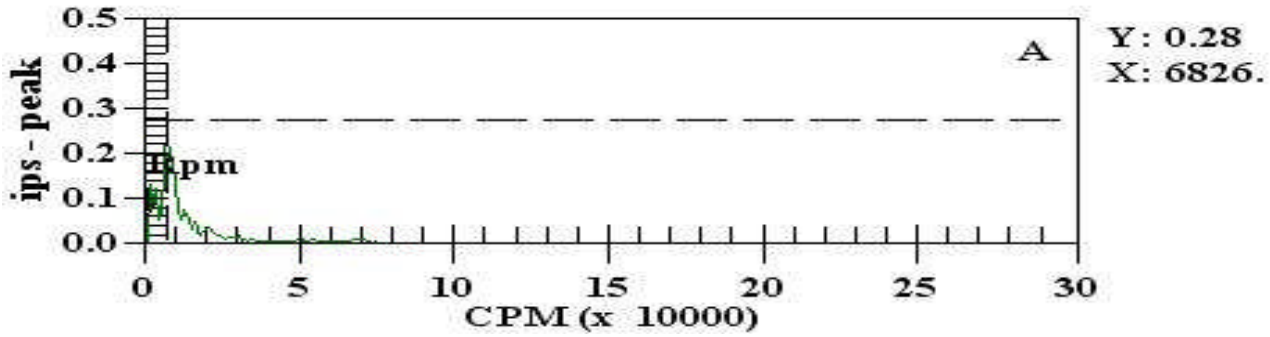


AS FOUND

OB FAN







Analysis:

The highest peak we found was at 15,233 cpm or approximately 12.69 times the motors operating speed (15,233 cpm/1200 cpm). This peak was obviously not a result of rotor bars (30x-60x rpm), motor cooling fan blade passing frequency (Nx), imbalance (1x) or even misalignment (1x/2x). The frequency was not a half-time multiple (.5x, 1.5x…8.5x rpm) of operating speed that rotor rubs or bearings loose in their housing can produce. Our technician also conducted a resonance test on the structure and found that this peak was not the result of a resonant condition. Unfortunately the customer did not have access to the bearing fault frequency information so we could not verify if the frequency matched a known bearing frequency.

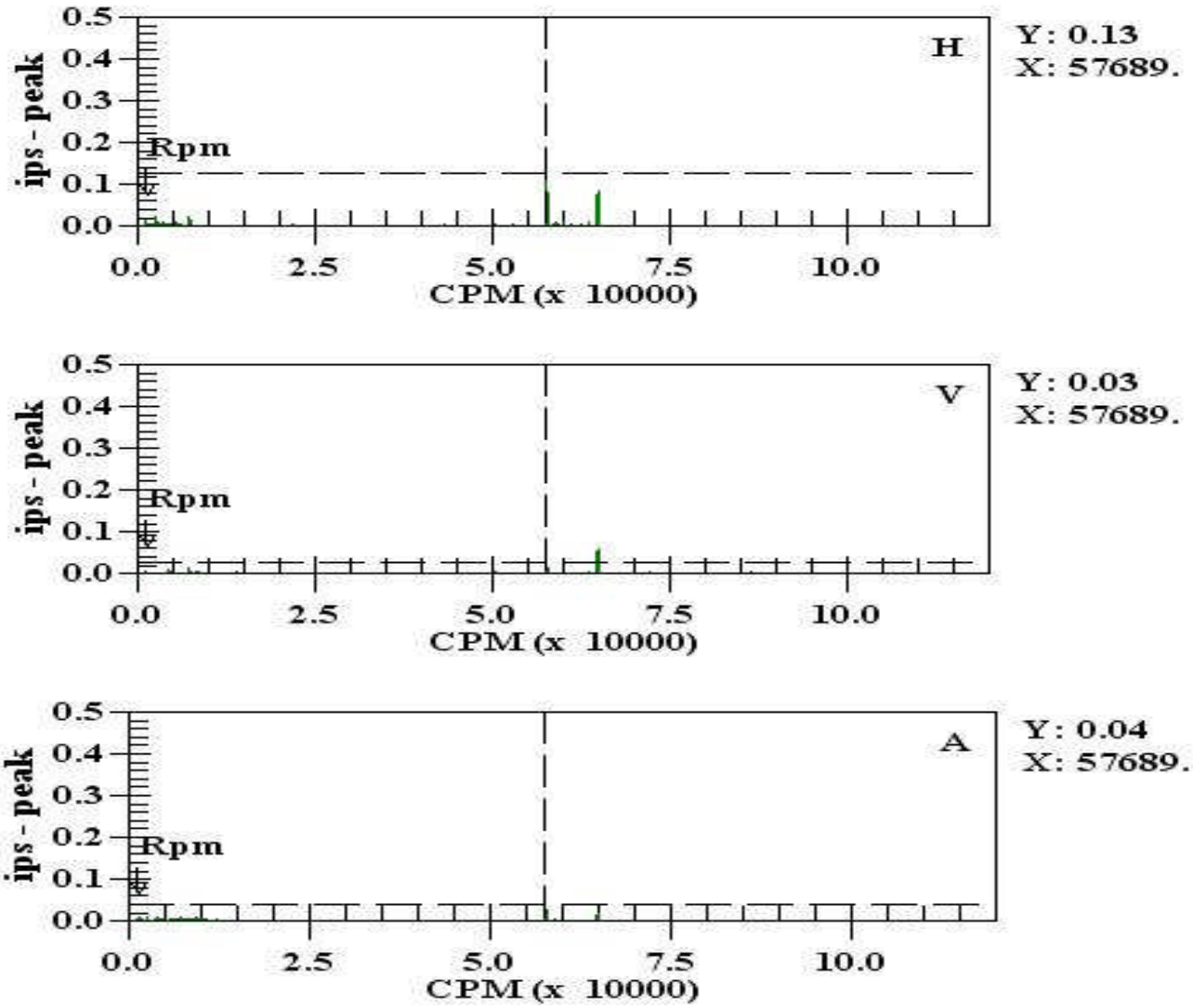
However, through the process of elimination, the analyst determined that the data did not fit anything other than a bearing fault. There were signs of looseness and the dominant peak at 12.69 times the motor's operating speed was where many bearing fault frequencies are found. As a result, our personnel recommended that the client replace the motor bearings.

Solution:

Once the motor bearings were replaced new vibration data (As –Left) was collected. The vibration quickly revealed the analysis was correct. The odd peak frequency at 12.69 times the motor's operating speed was a bearing fault frequency. The vibration levels drastically dropped and brought the vibration well within the acceptable criterion.

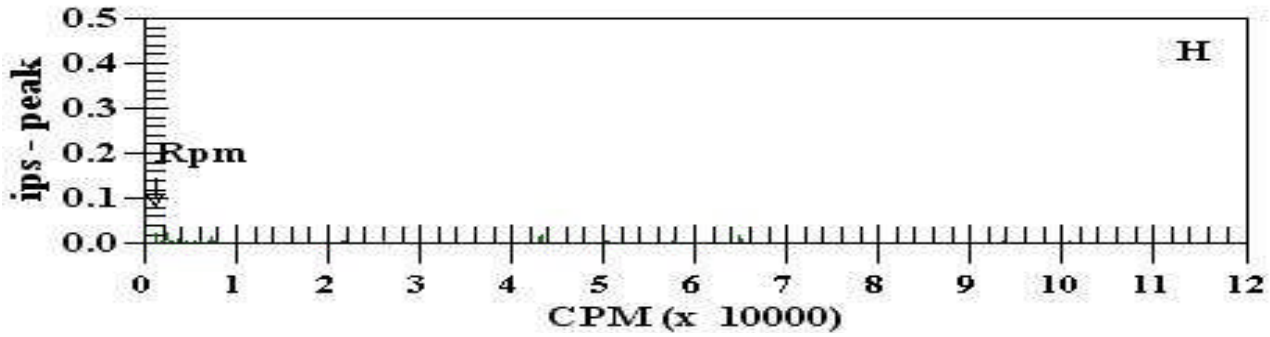
AS LEFT

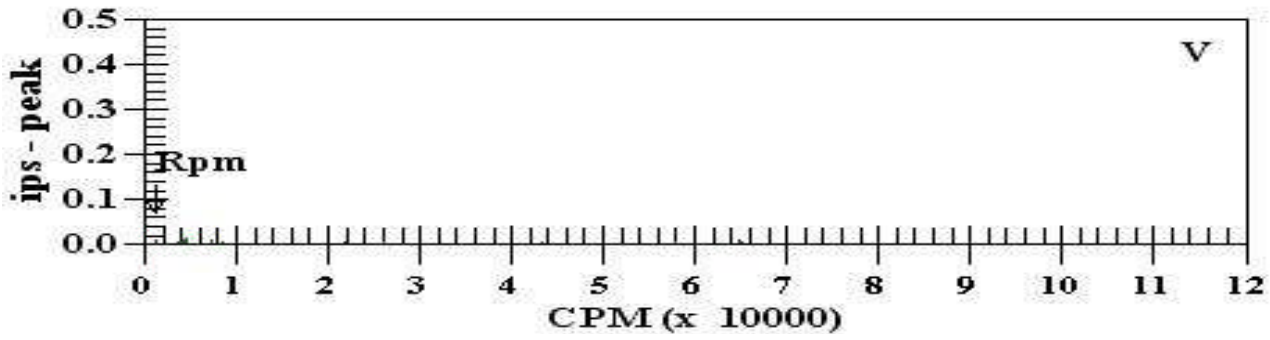
OB MOTOR

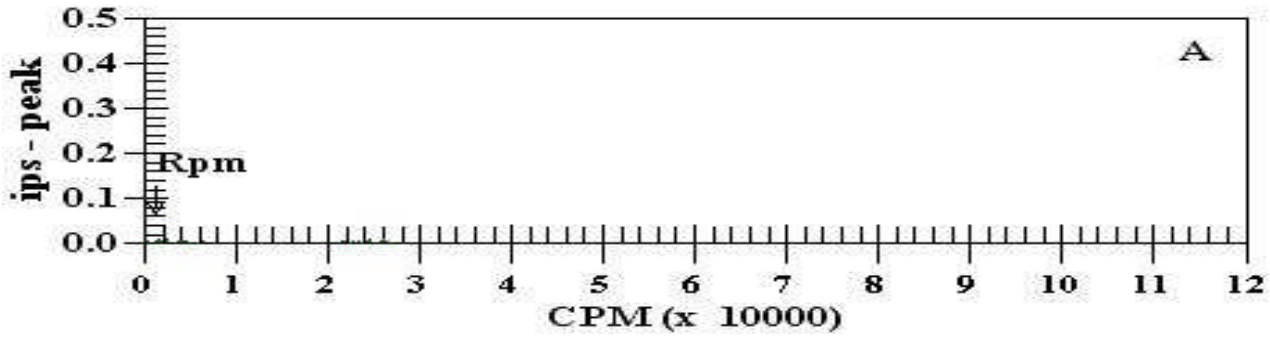


AS LEFT

IB MOTOR

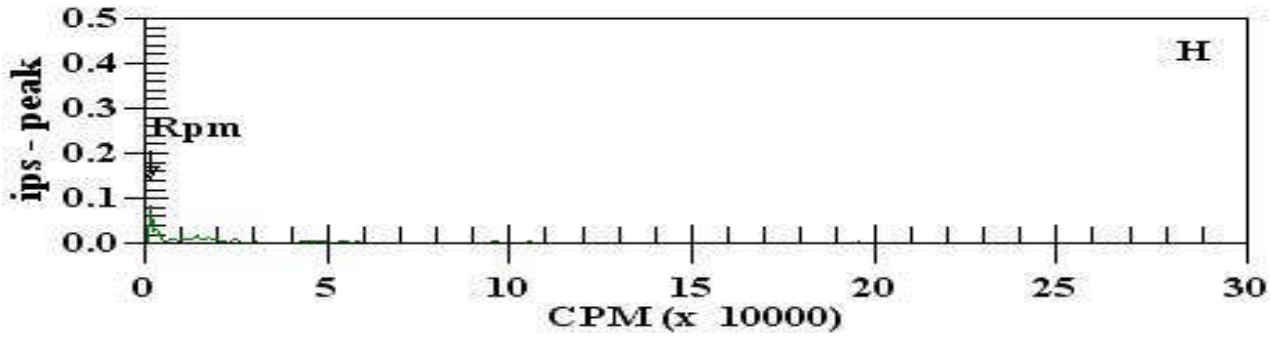


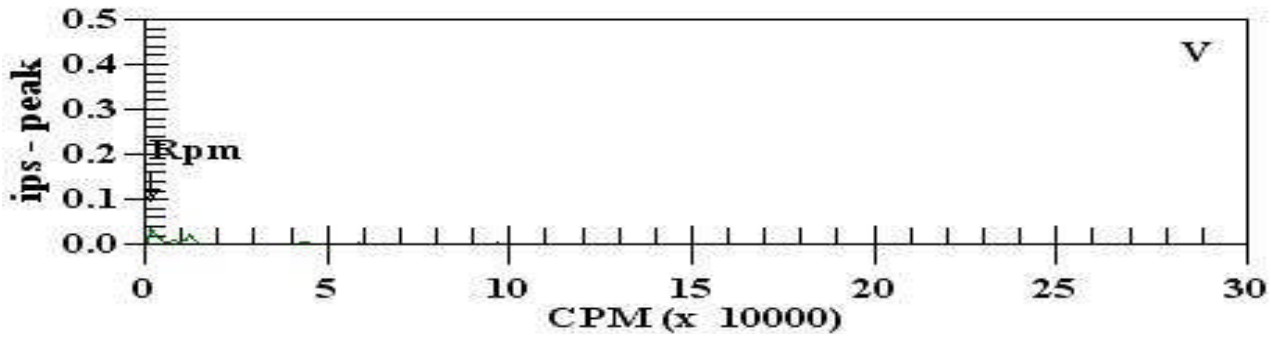


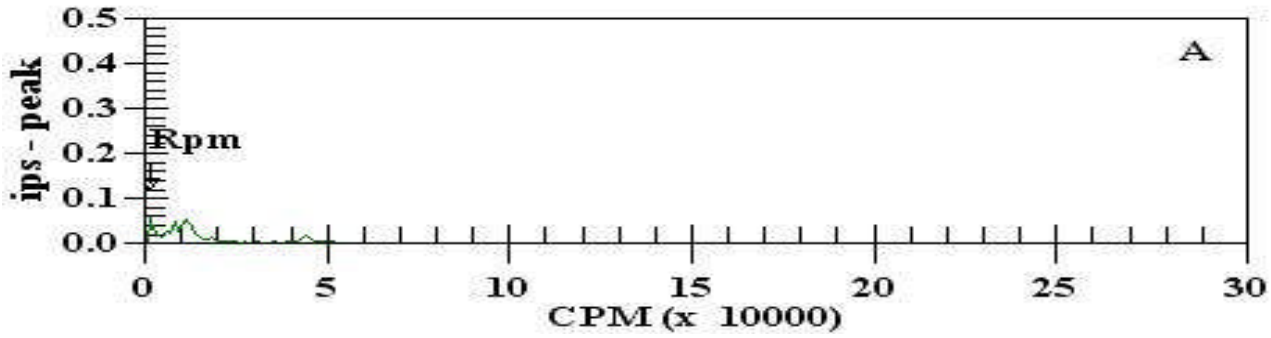


AS LEFT

IB FAN

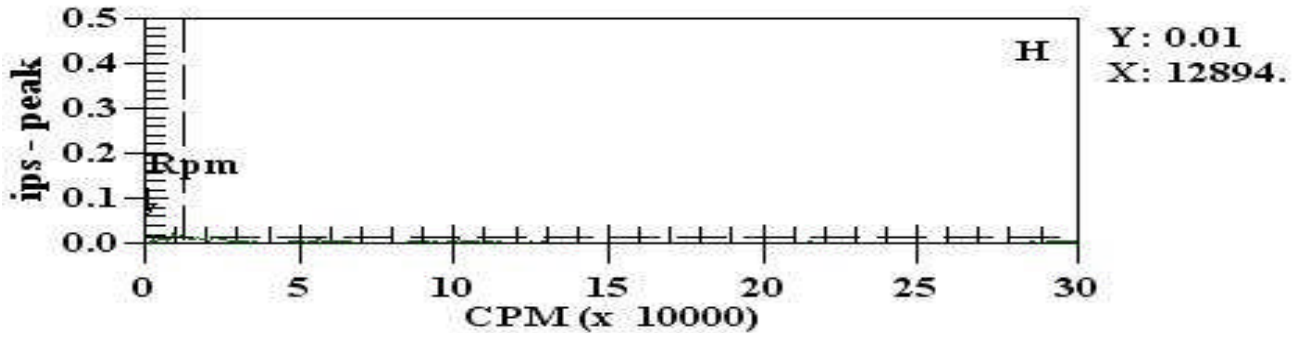


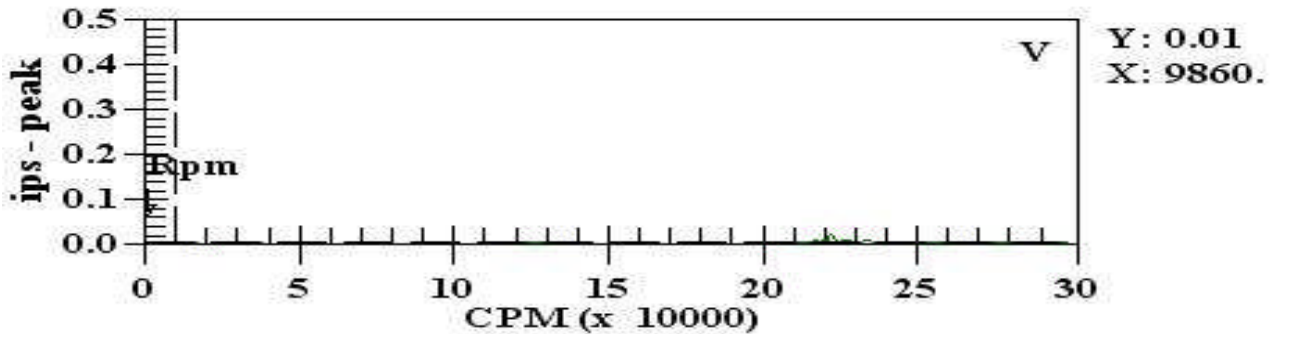


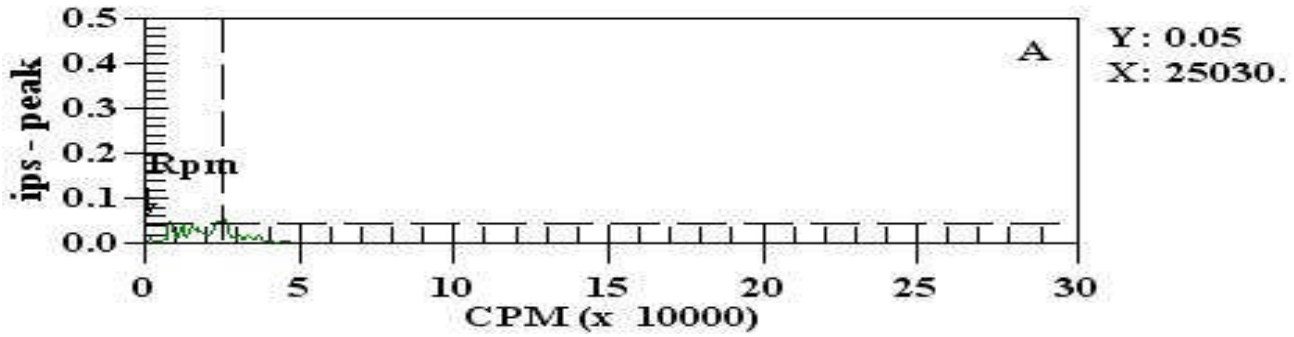


AS LEFT

OB FAN







Conclusion:

The as-found data does not suggest extraordinary dynamic loading (like imbalance or misalignment) which would cause the bearings to go bad on this fan-motor system. The client should review non-dynamic causes for these bad bearings such as improper installation, improper lubrication, under designed bearings, non-operating fretting due to background vibration, etc.

Even though the peak fan vibration levels (see the as-found data - axial direction) are only slightly lower than the motor peak levels the recommendation was to replace the motor bearings because:

1. The levels were higher on the motor

2. The data suggests severe bearing wear when the data is viewed in a log format (substantial mounds of vibration energy at the foot of the bearing frequency peak)

3. The fan bearings had been more recently replaced and were more likely to be in better condition than the motor bearings.