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Reference:
The following is a report from vibration data collected at Pohai Nani in Kaneohe, Hawaii on August 27 & 28, 2005

Mechanical vibration measurements were recorded on a Cogen unit, a Propane Engine Generator unit # 6-0111 at Pohai Nani, Kaneohe, Hawaii. Vibration measurements were recorded in units of velocity, acceleration and Spike Energy®. The measurements were collected with a Rockwell Automation model 1500 dataPAC Data Collector and a model 793 accelerometer transducer. The measurements were collected from each "A" frame bearing in the horizontal direction as well as vertical measurements from each cylinder head. The vibration data was collected with the Electro-flow connected to the system and then again once the Electro-flow was disconnected for approximately 4 hours. Once the data was collected it was downloaded into the Rockwell Automation Odyssey software for storage and report generation.

VIBRATION VELOCITY
Vibration velocity is a standard for evaluating the mechanical integrity of machinery. The vibration velocity takes into account the amount of displacement as well as the repetitious rate that the vibration is occurring. Therefore, it is a direct indicator of fatigue.

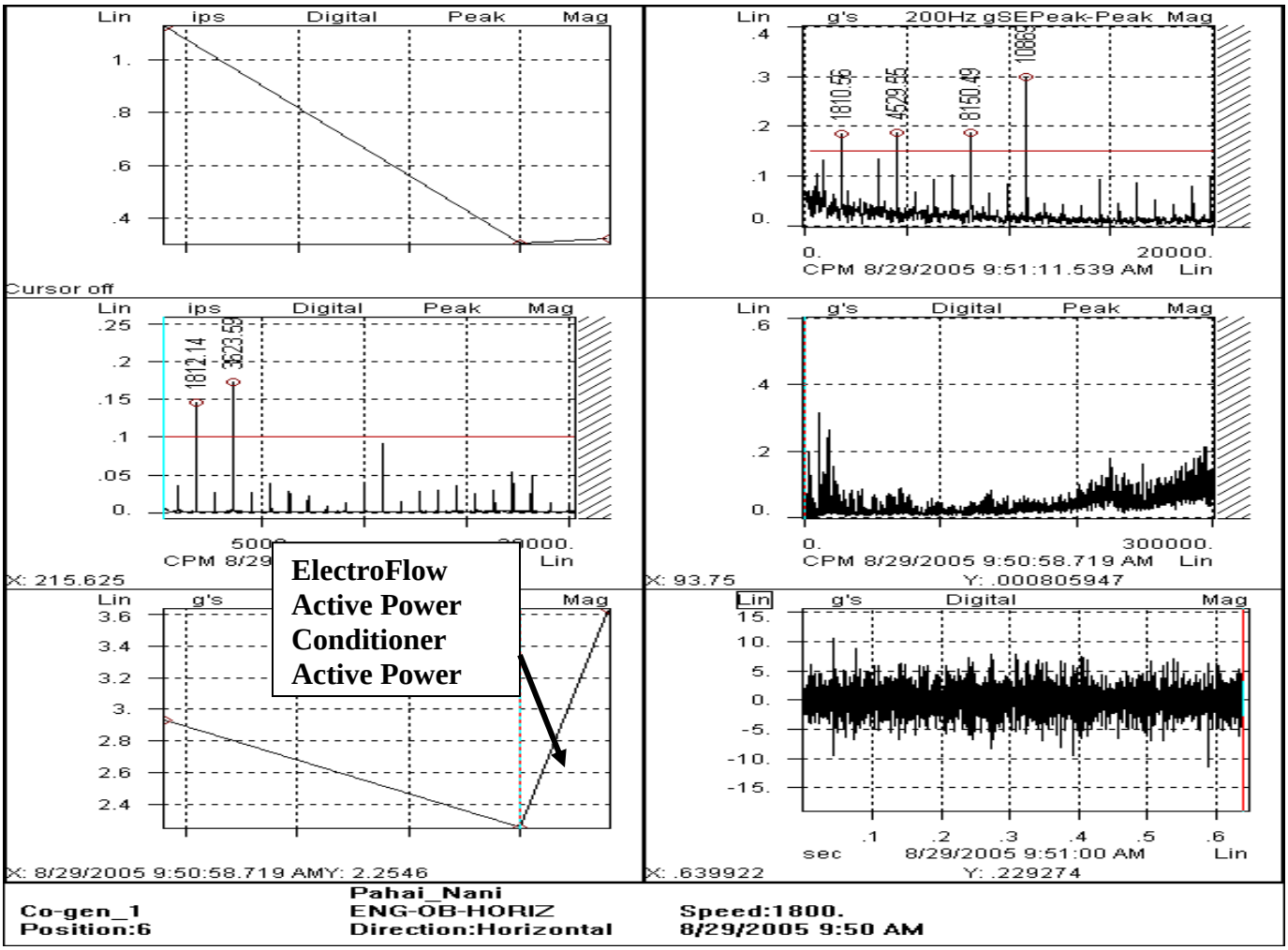
VIBRATION ACCELERATION
Vibration acceleration reveals the rate at which the vibration velocity is changing over time. Vibration acceleration is an excellent indicator of high frequency component forces. Acceleration measurements are made to evaluate the high frequency signals that occur due to defective electrical motor rotor bars, aerodynamic problems, anti-friction bearing problems, rubbing, cavitations in pumps etc as well as engine valve defects, piston slap and hydraulic force from gas ignition.

A MECHANICAL VIBRATION SPECTRUM
A mechanical vibration signature provides a view of the amplitude of the vibration signal at each discrete frequency. The "signature" illustrates, in graphic form, the amount of vibration velocity, acceleration or Spike Energy® that is present at each frequency observed. The frequency of the vibration is shown on the ordinate or across the graph from left to right. The amplitude of the signals is shown on the abscissa, or the vertical axis of the graph. Frequency is displayed in cycles per minute, CPM. The vibration amplitude is displayed in one of several testing parameters: Displacement, Velocity, Acceleration or Spike Energy.

FILTERED OUT VIBRATION

Unfiltered or filter out vibration is a composite of the vibration at the measurement point and in the direction that the vibration pickup is mounted. It is actually the vector sum of all the vibration present at that measurement point. The total filter out signal for the frequency range selected is displayed on the spectra graphs as a vertical bar. This is the total energy within the spectrum.

"A" FRAME CYLINDER # 6 – ELECTROFLOW ACTIVE POWER CONDITIONER ACTIVE POWER CONDITIONER DISCONNECTED

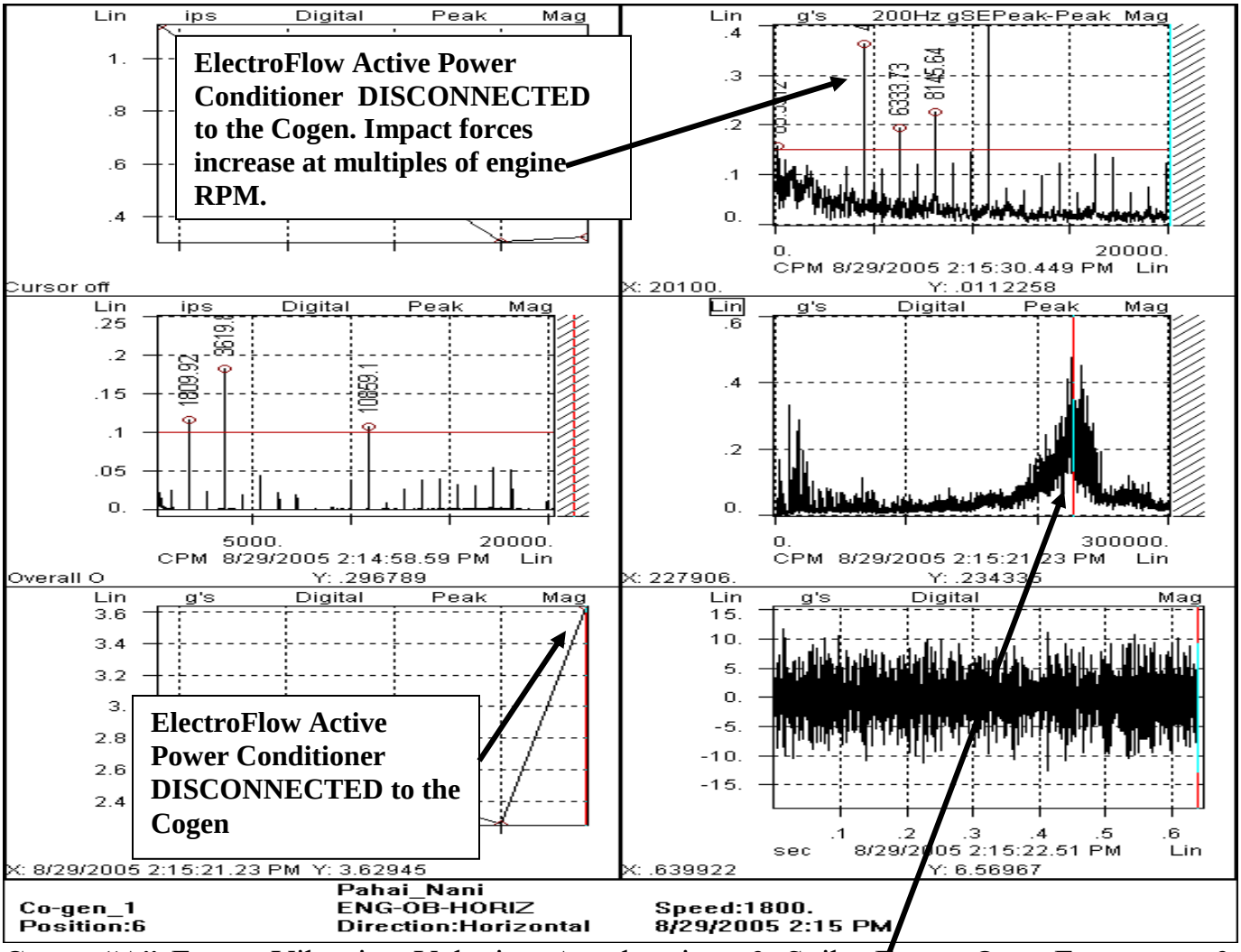


Cogen "A" Frame Vibration Velocity, Acceleration, & Spike Energy® vs Frequency & Time Waveform.

With the ElectroFlow **Active Power Conditioner connected** to the Cogen unit the vibration velocity levels at 1812 CPM and 3623 CPM are 0.15 and 0.17 in/sec. The total energy within the frequency range to 20,000 CPM is 0.32 in/sec.

The Spike Energy®, impact indicator signal, reveals GSE values at 1812, 4529, 8150 & 10875. The amplitude of these signals varies from 0.19 GSE to 0.3 GSE. The total energy under within the frequency range to 20,000 CPM is 0.94 GSE.

"A" FRAME CYLINDER # 6 – ELECTROFLOW ACTIVE POWER CONDITIONER ACTIVE POWER CONDITIONER DISCONNECTED.

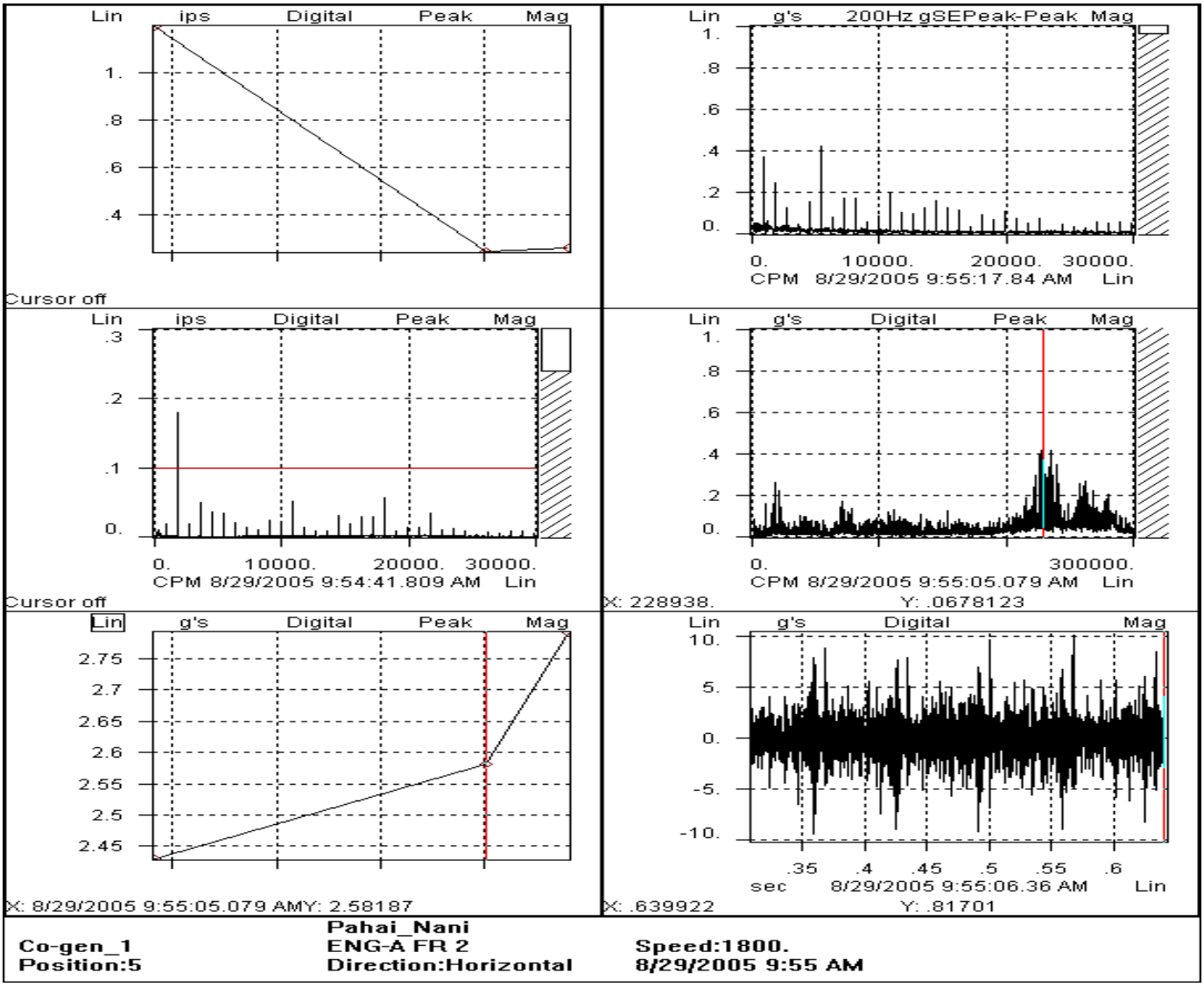


Cogen "A" Frame Vibration Velocity, Acceleration, & Spike Energy® vs Frequency & Time Waveform.

With the **ElectroFlow Active Power Conditioner disconnected** to the C0-Gen unit the vibration velocity levels at 1812 CPM and 3623 CPM are 0.11 and 0.18 in/sec. The total energy within the frequency range to 20,000 CPM is 0.30 in/sec.

The Spike Energy®, impact indicator signals; reveal GSE values at 4518, 8150 & 10875. The amplitude of these signals varies from 0.19 GSE to 0.36 GSE. The total energy under within the frequency range to 20,000 CPM is 1.32 GSE, an increase of 40%. The high frequency acceleration forces at 227,905 CPM increased by 100 %.

“A” FRAME CYLINDER # 6 ELECTROFLOW ACTIVE POWER CONDITIONER CONNECTED.

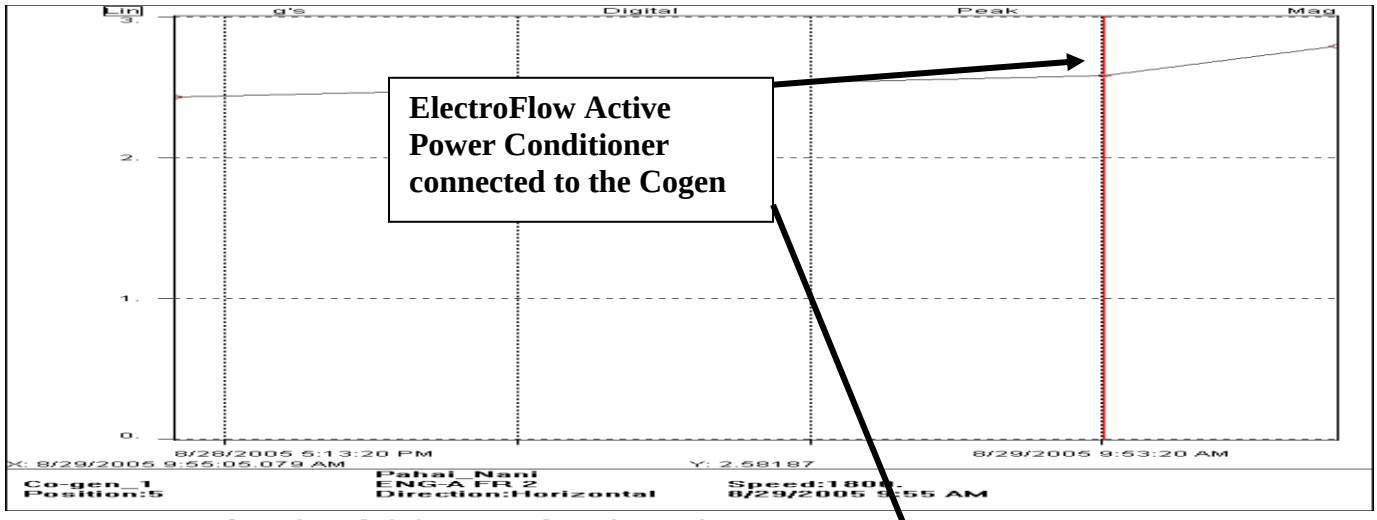


Cogen “A” Frame Vibration Velocity, Acceleration, & Spike Energy® vs Frequency & Time Waveform.

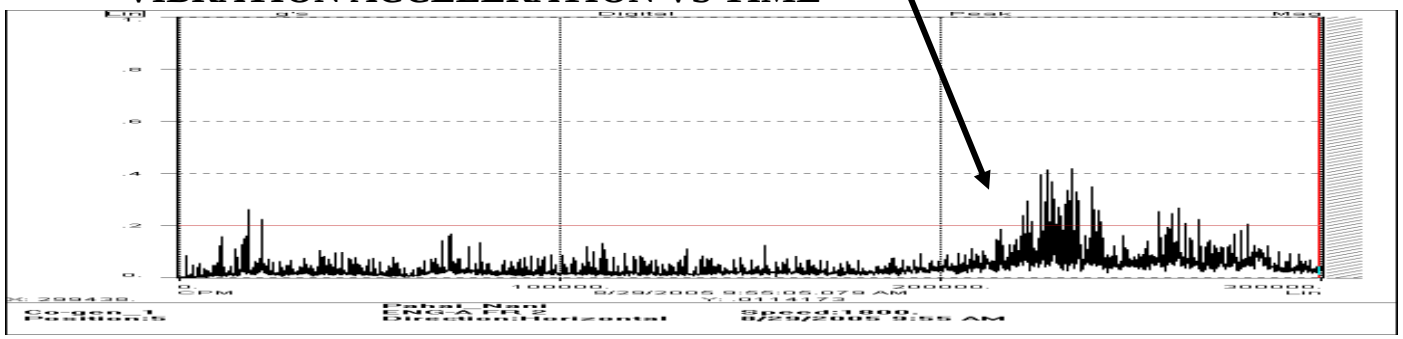
With the **ElectroFlow Active Power Conditioner connected** to the Cogen unit the vibration velocity levels at 1812 CPM is 0.179 in/sec. The total energy within the frequency range to 20,000 CPM is 0.24 in/sec.

The Spike Energy®, impact indicator signals; reveal GSE values at 4518, 8150 & 10875. The amplitude of these signals varies from 0.19 GSE to 0.36 GSE. The total energy under within the frequency range to 20,000 CPM is 1.32 GSE, an increase of 40%. The high frequency acceleration forces at 227,905 increased by 100 %.

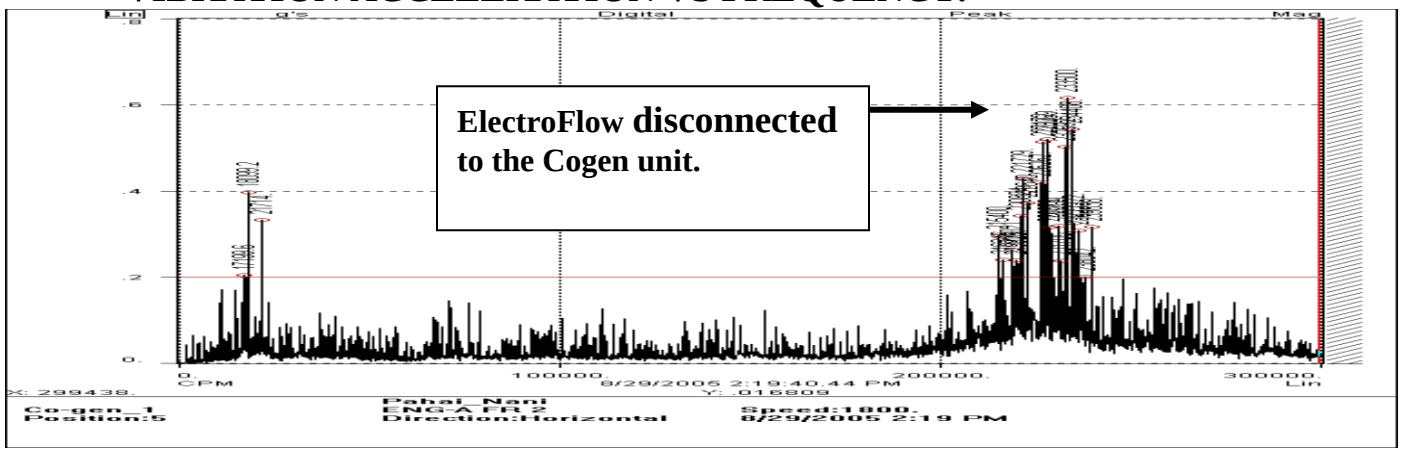
“A” FRAME CYLINDER # 5 –



VIBRATION ACCELERATION VS TIME



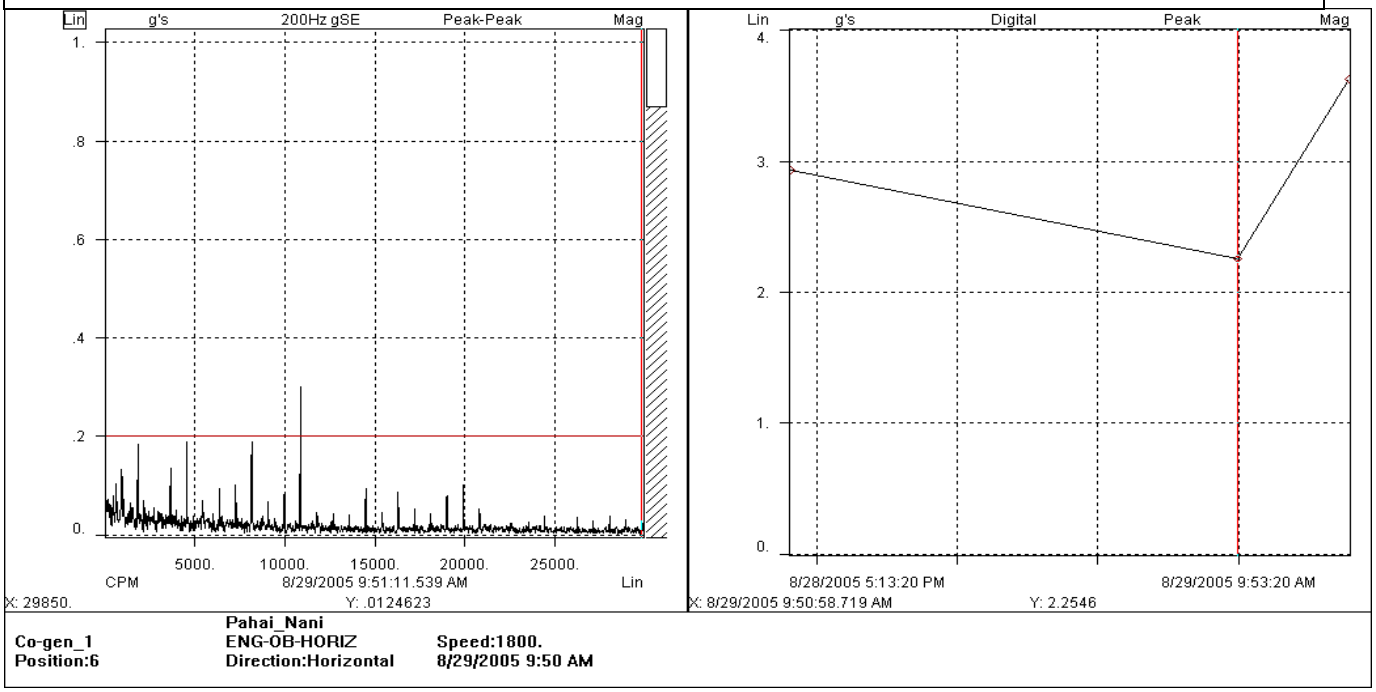
VIBRATION ACCELERATION VS FREQUENCY.



VIBRATION ACCELERATION VS FREQUENCY.

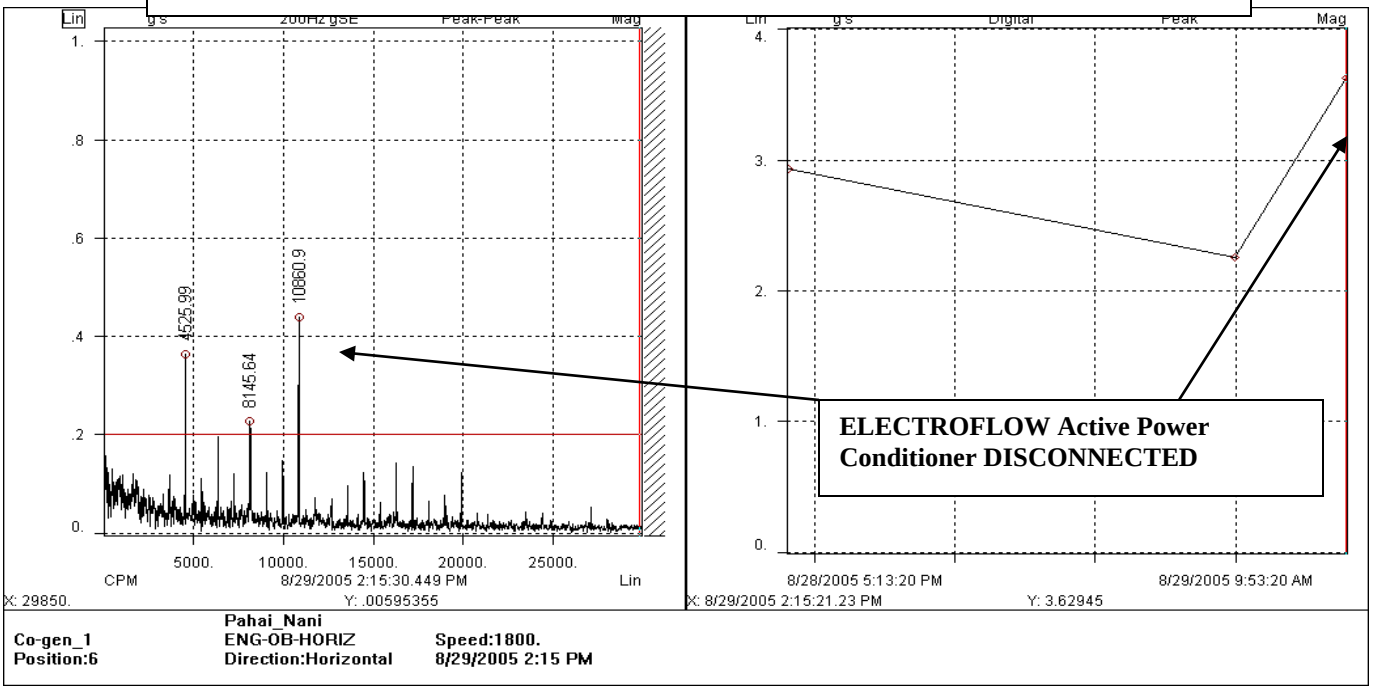
On “A” frame # 5 the high frequency acceleration increased by 50 % and over a wide band. The total acceleration energy increased from 2.6 to 2.8 G’s.

ELECTROFLOW **Active Power Conditioner** CONNECTED



VIBRATION SPIKE ENERGY® VS FREQUENCY ENGINE CYLINDER # 1

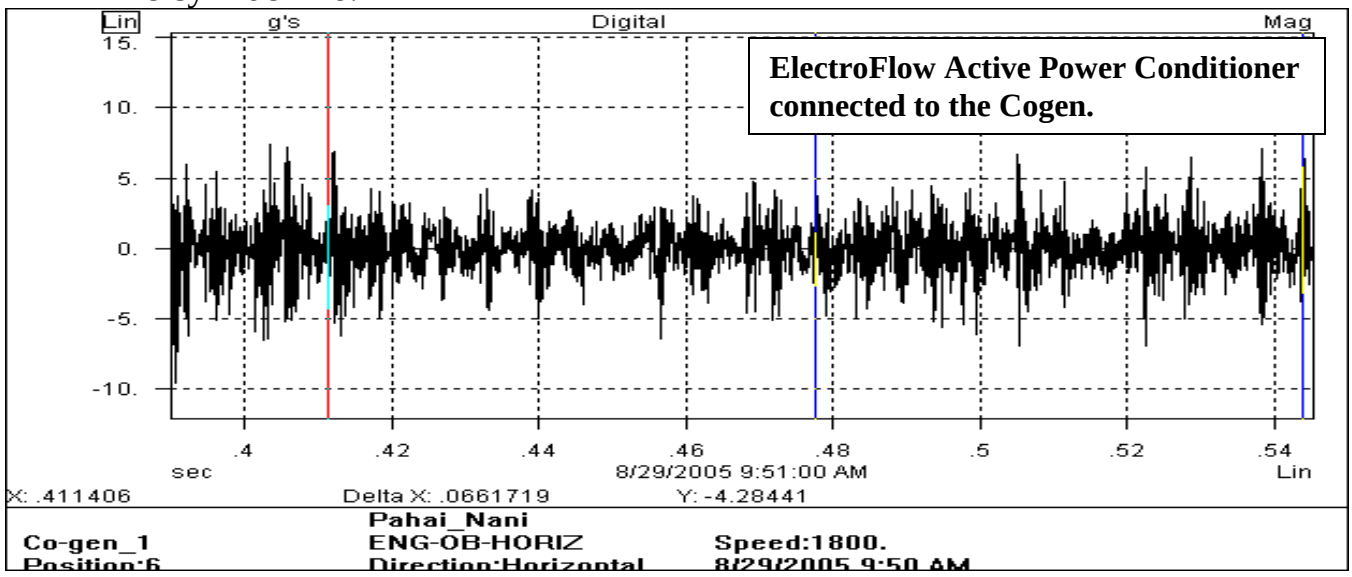
ELECTROFLOW Active Power Conditioner DISCONNECTED



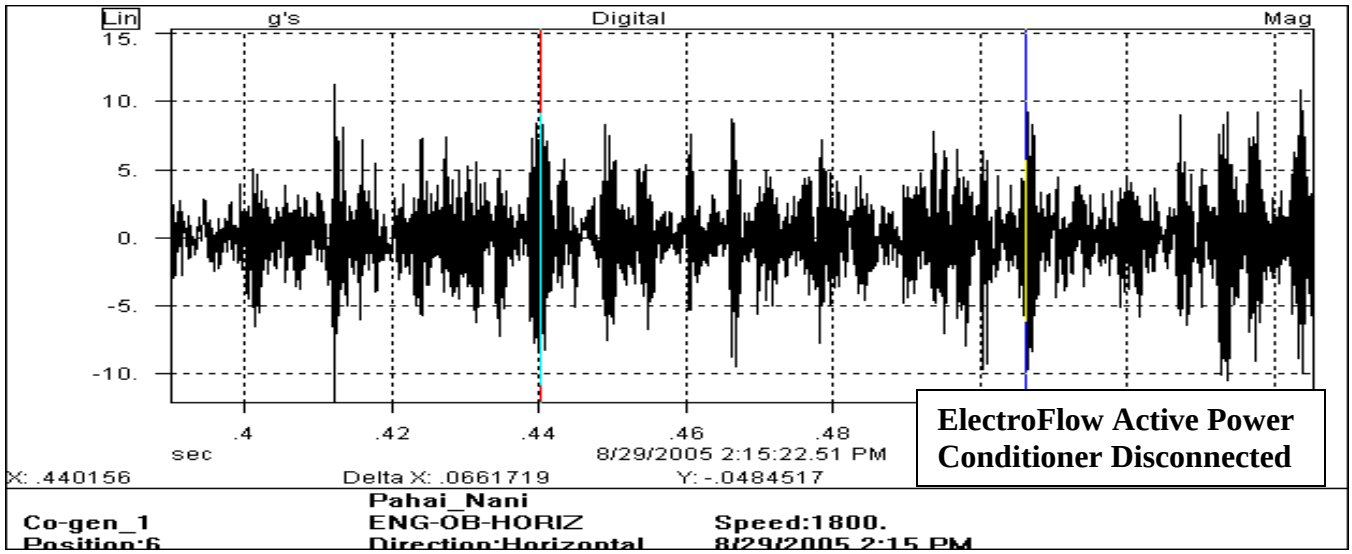
VIBRATION SPIKE ENERGY® VS FREQUENCY ENGINE CYLINDER # 1

Spike energy® signals (metal-to-metal) impact signals doubled on the “A” frame cylinder # 6 when the Electro-flow was disconnected.

“A” frame cylinder # 6.



ACCELERATION VS TIME “A” FRAME # 6 HORIZONTAL

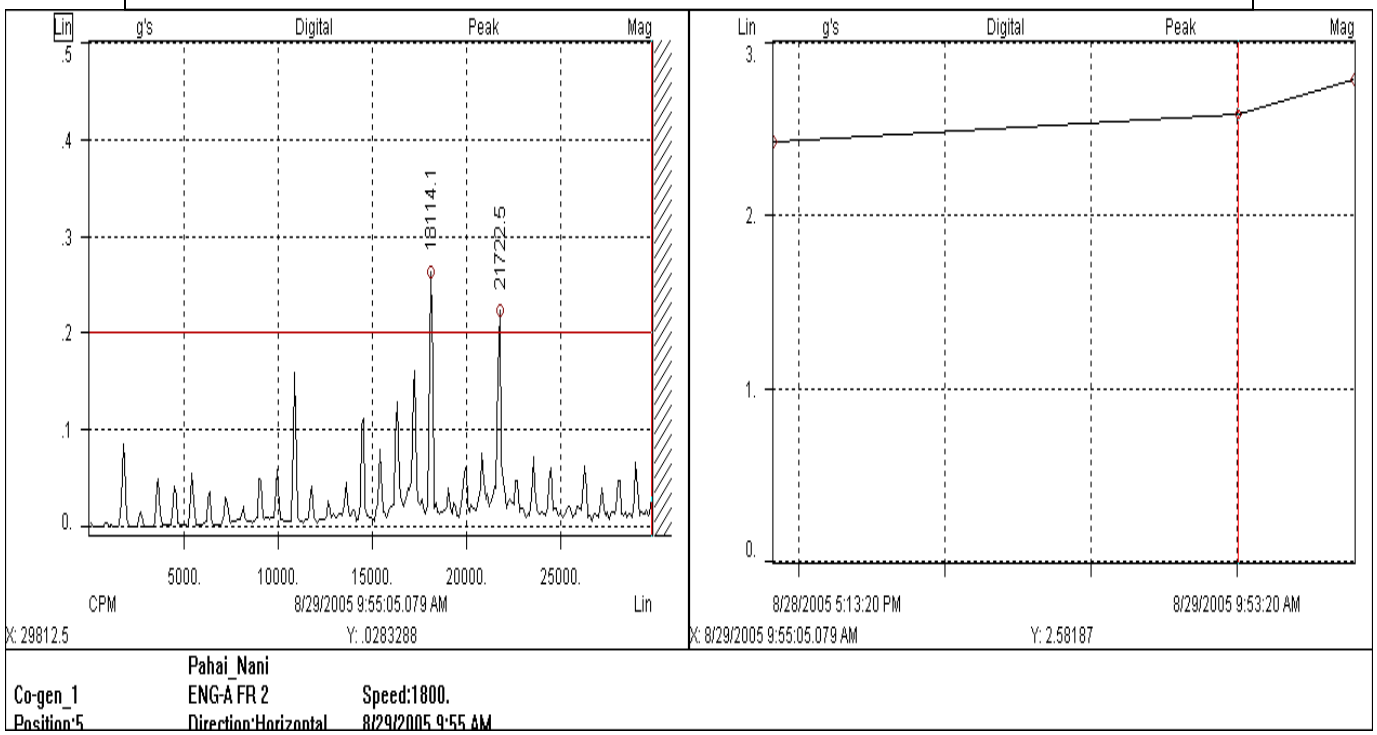


ACCELERATION VS TIME “A” FRAME # 6 HORIZONTAL

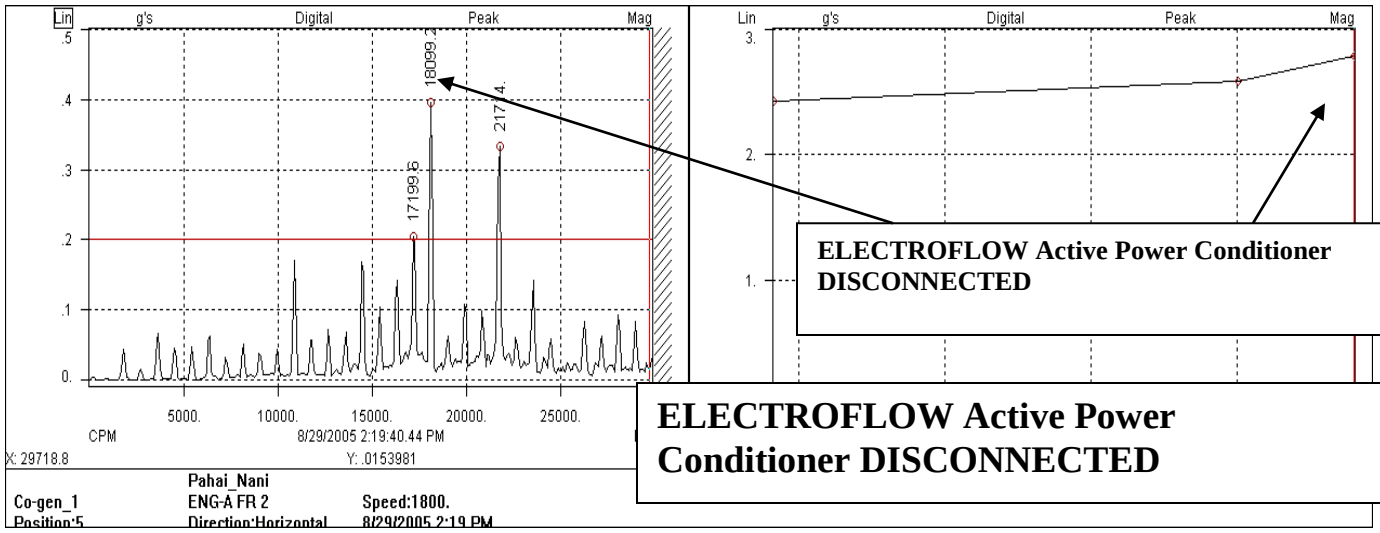
The acceleration levels went from a 13 G peak-to-peak swing with Electro-flow connected to a 19 G peak-to-peak swing when the ElectroFlow was disconnected. That is a 46 % increase in the acceleration forces during the engine power stroke.

The following is a summary of acceleration signatures along with trends with ElectroFlow Active Power Conditioner Active Power Conditioner connected and disconnected.

ELECTROFLOW Active Power Conditioner CONNECTED



VIBRATION ACCELERATION VS FREQUENCY ENGINE "A" FRAME # 2 HOR



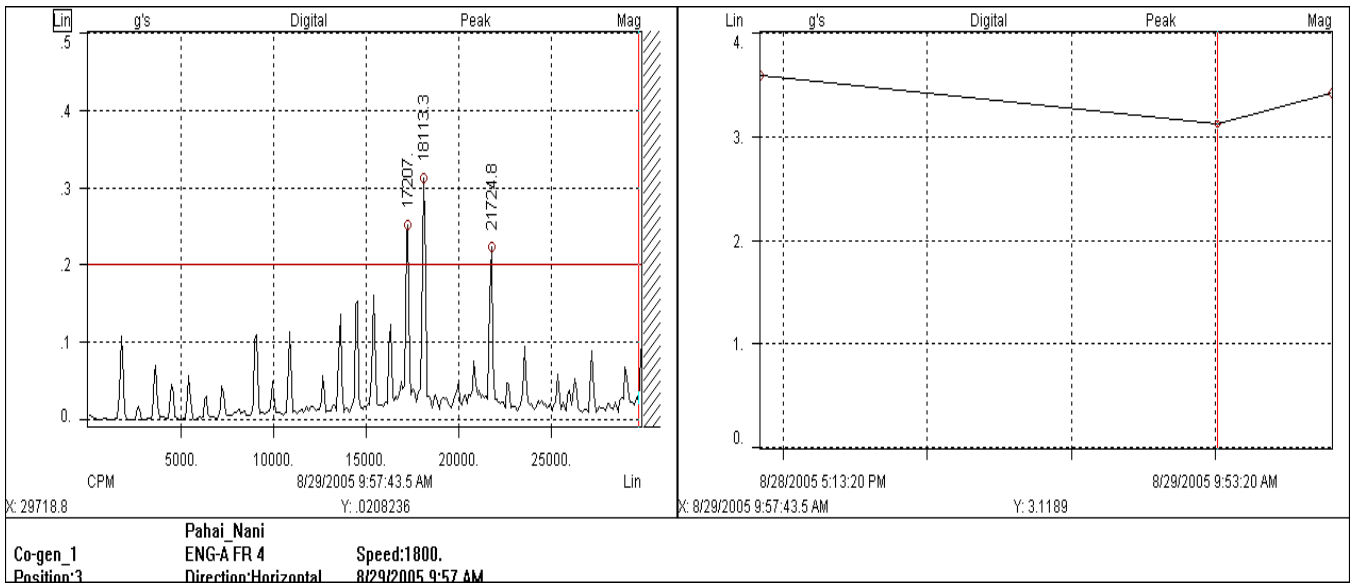
ELECTROFLOW Active Power Conditioner DISCONNECTED

ELECTROFLOW Active Power Conditioner DISCONNECTED

VIBRATION ACCELERATION VS FREQUENCY ENGINE "A" FRAME # 2 HOR

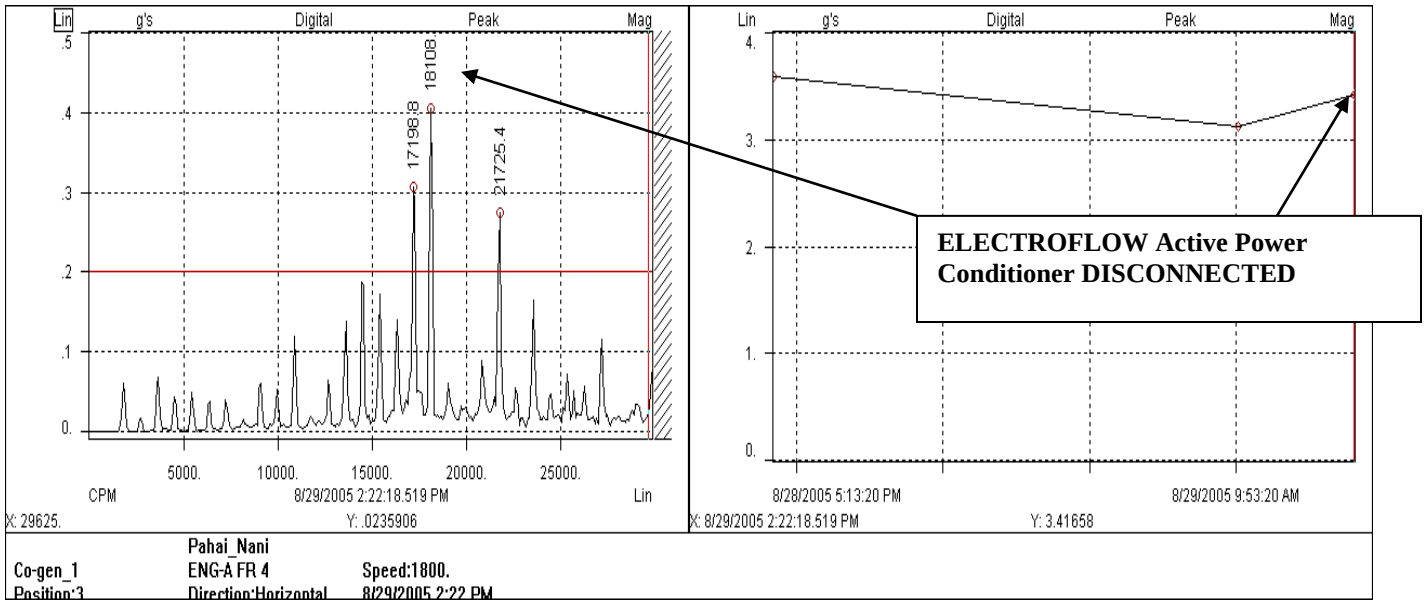
Acceleration forces at multiples or harmonics of shaft RPM increased by over 25% on cylinder # 5 when the ElectroFlow was disconnected.

ELECTROFLOW Active Power Conditioner CONNECTED



VIBRATION ACCELERATION VS FREQUENCY ENGINE "A" FRAME # 4 HOR

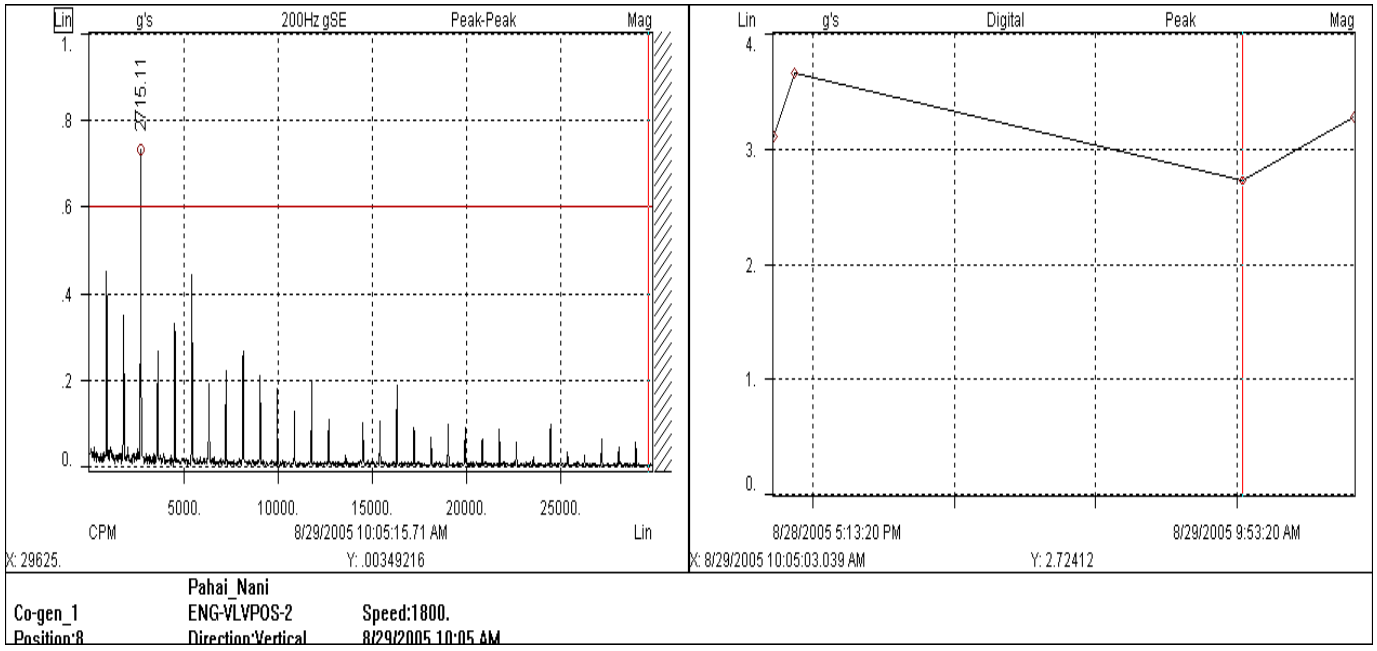
ELECTROFLOW Active Power Conditioner DISCONNECTED



VIBRATION ACCELERATION VS FREQUENCY ENGINE "A" FRAME # 4 HOR

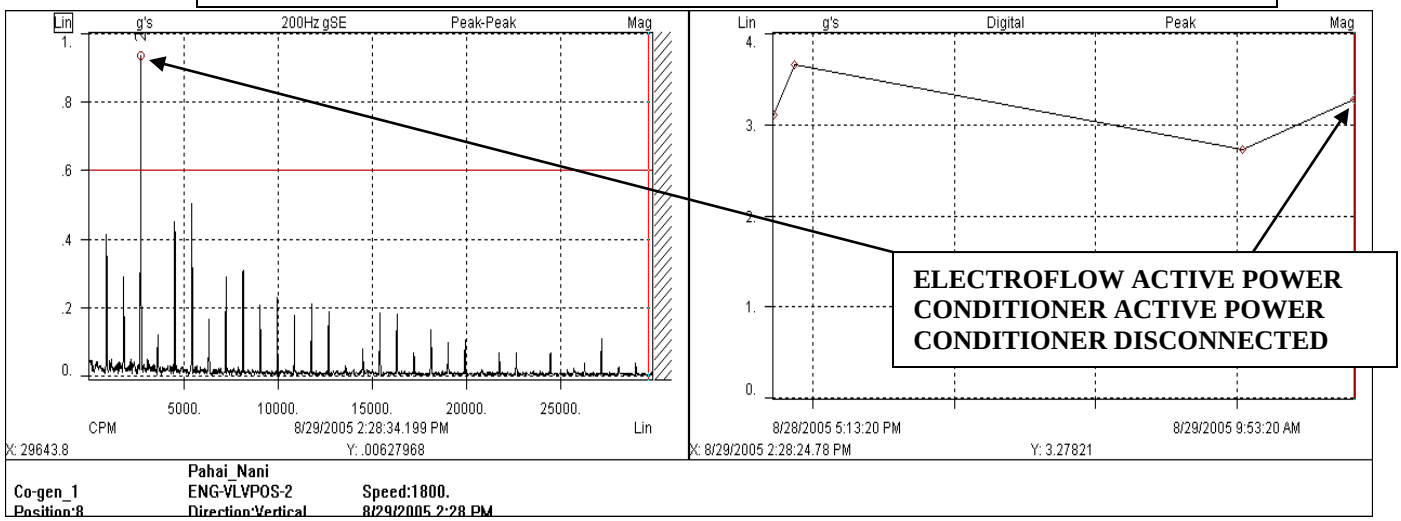
Acceleration forces at multiples or harmonics of shaft RPM increased by over 25% on "A" Frame # 4 when the ElectroFlow was disconnected.

ELECTROFLOW Active Power Conditioner CONNECTED



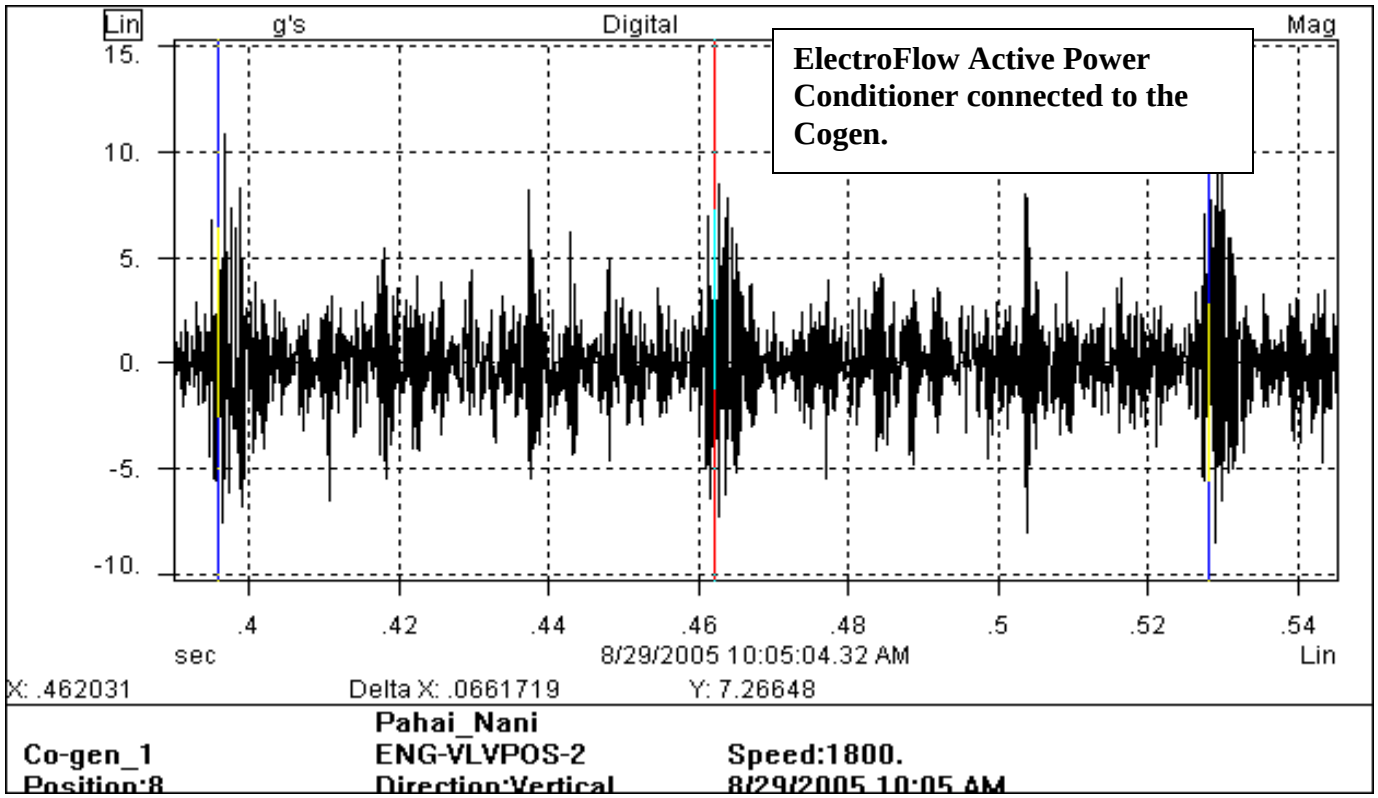
VIBRATION ACCELERATION VS FREQUENCY ENGINE "VALVE" # 2 VERTICAL

ELECTROFLOW Active Power Conditioner DISCONNECTED

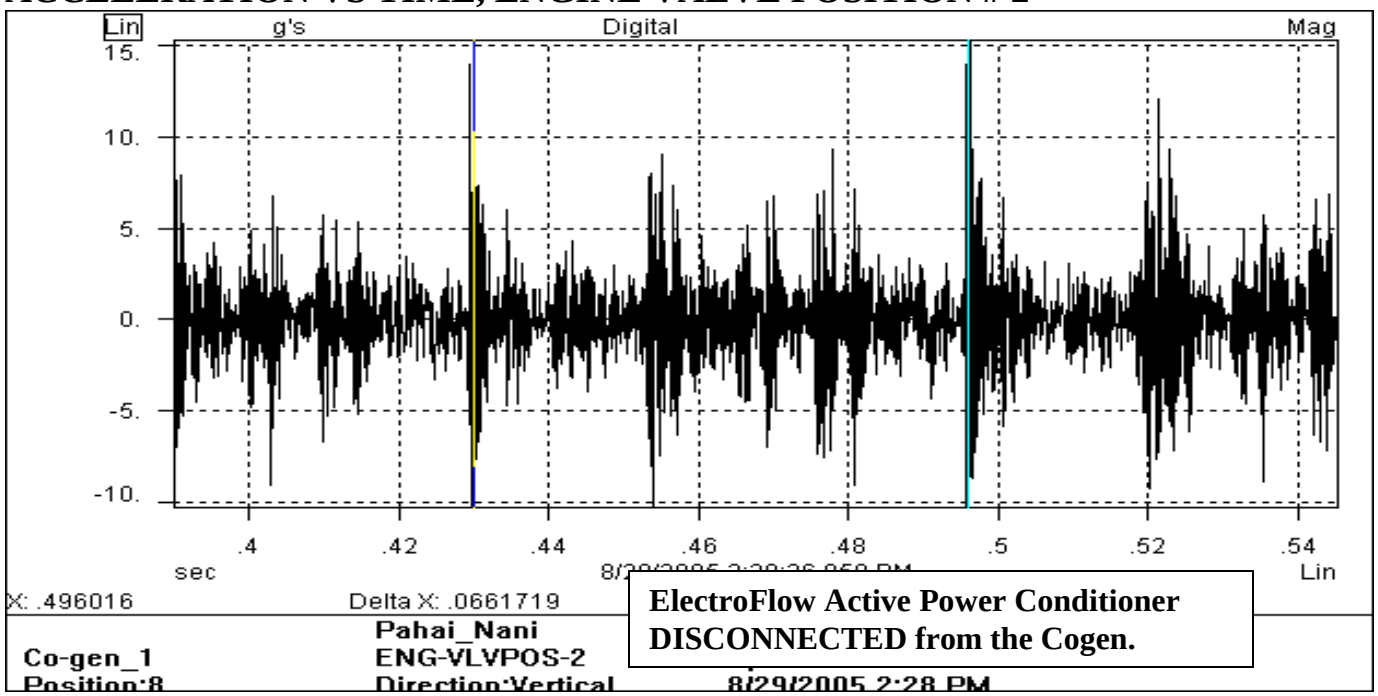


VIBRATION ACCELERATION VS FREQUENCY ENGINE "VALVE" # 2 VERTICAL

Acceleration forces at multiples or harmonics of shaft RPM increased by over 16 % on "VALVE # 2" when the ElectroFlow was disconnected.



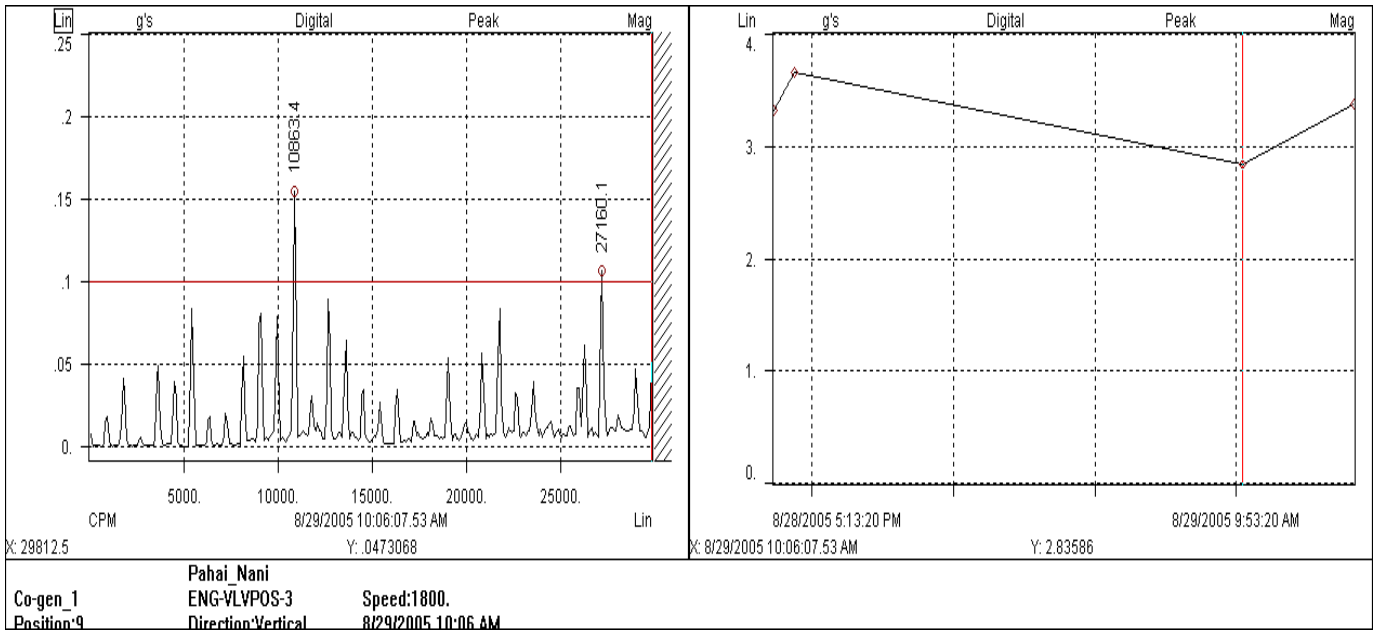
ACCELERATION VS TIME, ENGINE VALVE POSITION # 2



ACCELERATION VS TIME, ENGINE VALVE POSITION # 2

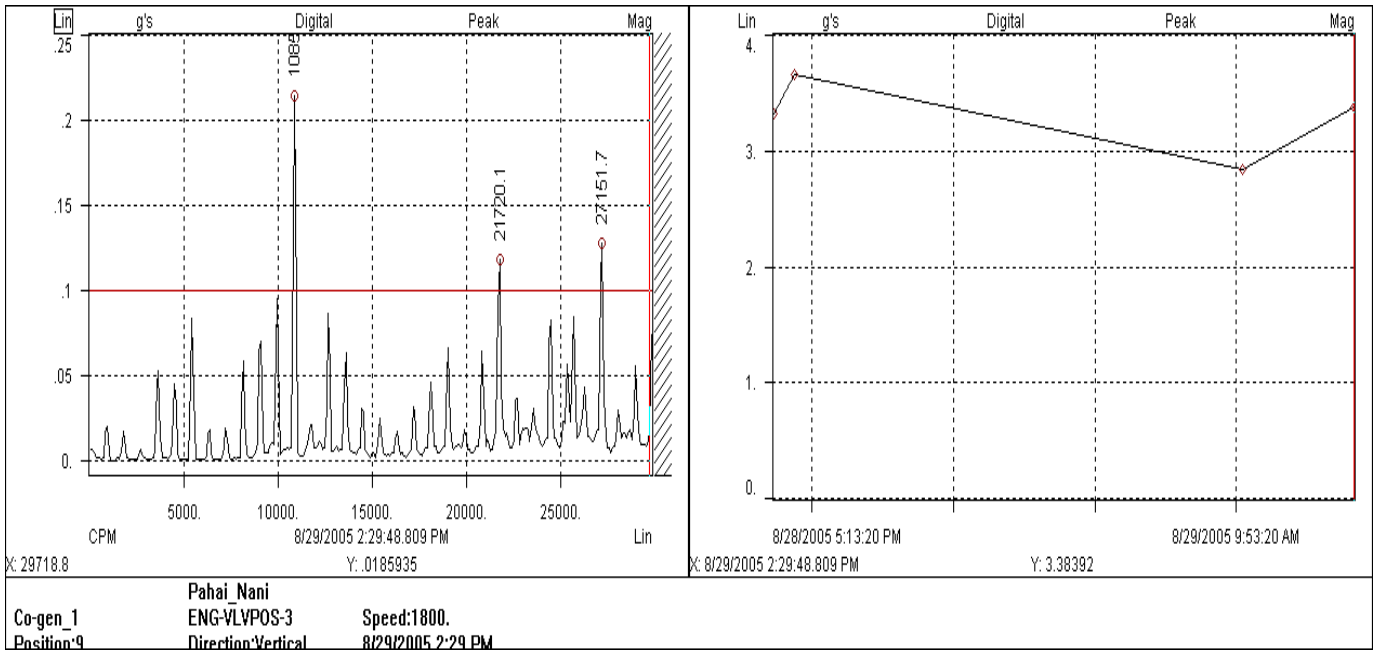
The acceleration levels went from a 19 G peak-to-peak swing with ElectroFlow connected to a 31 G peak-to-peak swing when the ElectroFlow was disconnected. That is a 63 % increase in the acceleration forces at the engine during the power stroke.

ELECTROFLOW Active Power Conditioner CONNECTED



VIBRATION ACCELERATION VS FREQUENCY ENGINE “VALVE” # 3 VERTICAL

ELECTROFLOW Active Power Conditioner DISCONNECTED



VIBRATION ACCELERATION VS FREQUENCY ENGINE “VALVE” # 3 VERTICAL

Acceleration forces at multiples or harmonics of shaft RPM increased by over 25 % on “VALVE # 3” when the ElectroFlow Active Power Conditioner was disconnected.

IN CONCLUSION:
When the ElectroFlow is connected to the Cogen unit the mechanical vibration is reduced, especially the vibration acceleration at high frequencies around 228,000 CPM as well s the Spike Energy® impact forces on several cylinders.

In addition, it appears as though the physical dynamics of the engine changes with the Electro-flow connected. The focal point of radial flexing as noted by the vibration signals changes to a different longitudinal location with the ElectroFlow connected. This maybe due to smoother input voltages along with less high frequency acceleration forces and Spike Energy® impact forces acting on the Cogen engine.

I noticed that the specific timing of the cylinder firing shifts 15 milliseconds later from when the ElectroFlow is connected to the Cogen then when the ElectroFlow is disconnected from the Cogen unit.

Mike Halsey