TipTop Electrical Power Facility
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Vibration Survey for
Boiler Feedwater Pump Train 1A

Submitted to

Mrs. Jeraldine Poe
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TipTop Power Station
Hot Springs Alaska
Managed by CPMG

Submitted on
January 1st 2014
By:

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Mrs. Poe,

Ludeca was asked to analyze data taken on Boiler Feed-water Pump 1A. Brian Franks of JetTech Mechanical collected the data on December 26th, 2013. No previous data was available on this pump train and only casing data (as opposed to relative shaft vibration via proximity probe) was available.

To help establish a baseline of conditions on this machine train, Mr. Franks collected the vibration data from Boiler Feed-water Pump 2A along with the necessary data for a basic phase analysis on the train. It should be noted that trending condition over time is a powerful tool for vibration analysis. This allows for the unique foundation, ambient environment, mass, stiffness, mounting, and such to have its proper influence on an analysis. For example, two machines may look exactly alike, run the same speed, and do the same job, but because of differences during fabrication, assembly, mounting, interconnection to related equipment, and etcetera they may have completely different levels of healthy vibration. Base lining and trending helps to compensate for such differences. Trending not being possible at this time, Ludeca will make their best assessment of the data available.

Unbalance and misalignment are conditions which can severely shorten the life of expensive equipment when they are allowed to exist at harmful magnitudes. They are also conditions which ALWAYS exist to some degree. It would be too expensive to get a machine to a perfectly balanced and/or aligned condition. This being the case, we are striving to determine, to the best of our ability, whether or not the levels present warrant expensive action. The goal is to simply minimize them to the point they are not negatively impacting the useful life of the equipment.

This report will conclude with any observations that might help in future analysis and with a "Machine Condition Summary".

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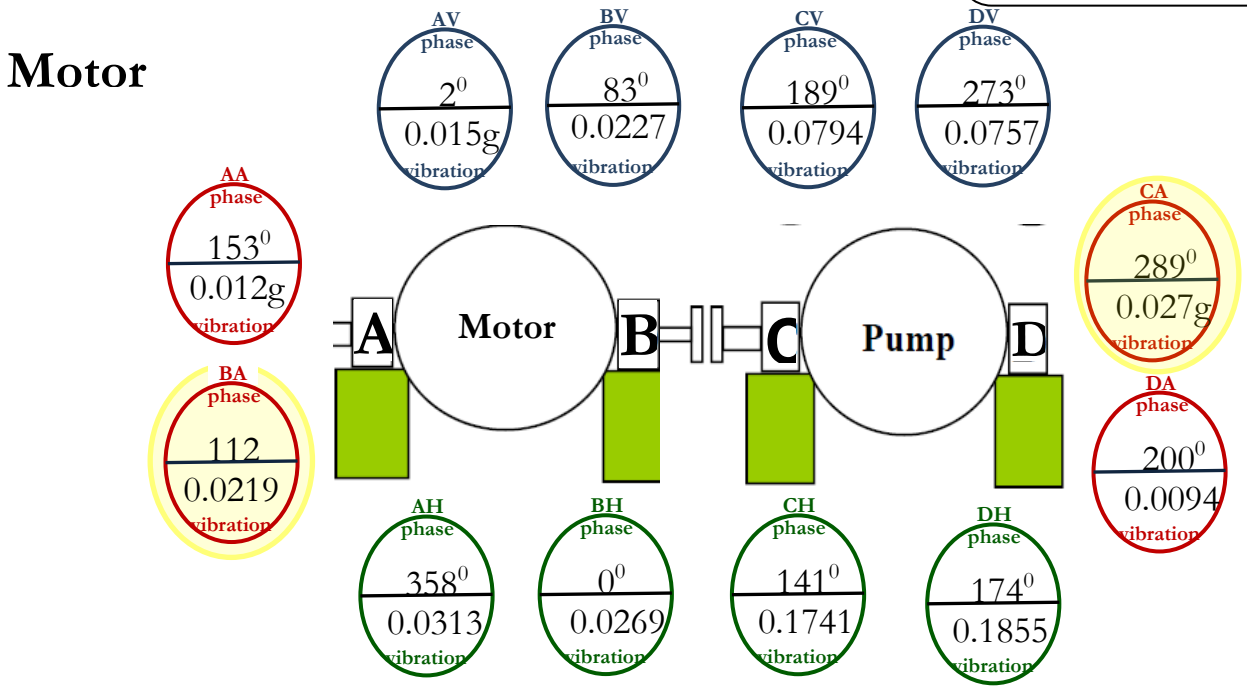
Boiler Feed-water Pump Train 1A Phase Analysis

The phase analysis reveals that the axial readings across the coupling are 180^0 out of phase. It should also be noted that while each machine is relatively in phase end to end, they are out of phase to one another. These facts indicate some misalignment, but the amplitudes are relatively low. (see Fig 1)

Amplitude units are: ✖ Acceleration 0-p
□ Velocity 0-p
□ Displacement p-p

Legend	
Horizontal	Green
Vertical	Blue
Axial	Red



Direction	A	B	C	D
A	153^0	112^0	289^0	200^0
H	358^0	0^0	141^0	174^0
V	2^0	83^0	189^0	273^0

Fig 1

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Boiler Feed-water Pump Train 1A Vibration Analysis

BFP 1A motor

Figure 2 is a side by side comparison of the inboard axial frequency spectrums of 1A on the left and 2A on the right. There is a raised noise floor throughout the spectrum of 1A axial. This indicates random broad band activity and even extends into the higher frequency ranges. The extent of the high frequency excitation is clearly portrayed when the acceleration time waveform of 1A on the left is compared to 2A on the right with the same scale (Fig 3). We cannot say with certainty what the cause of this high frequency content is, but the coupling should be thoroughly checked including its lubrication (if applicable).

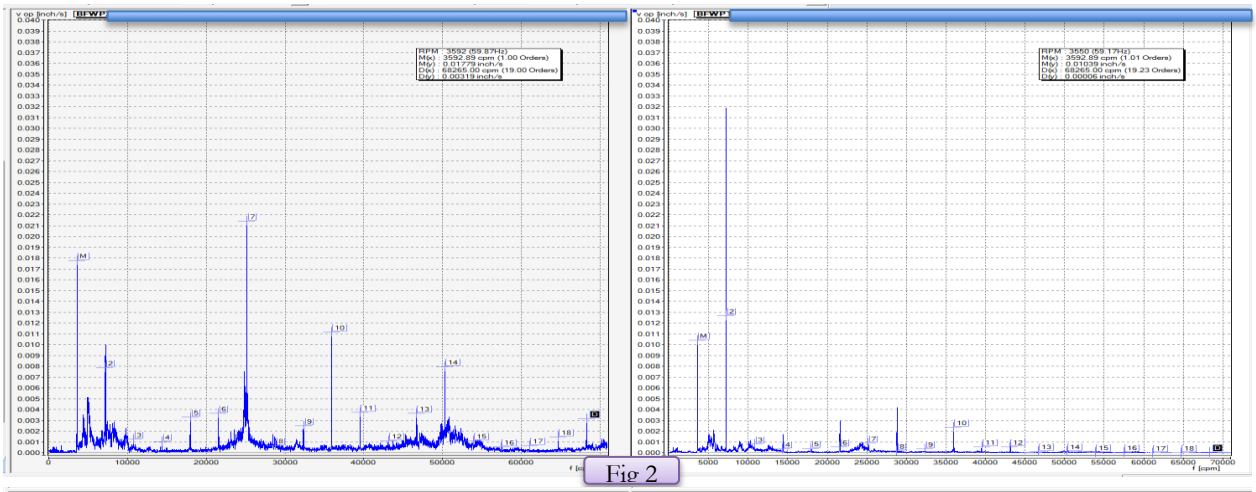

Fig 2

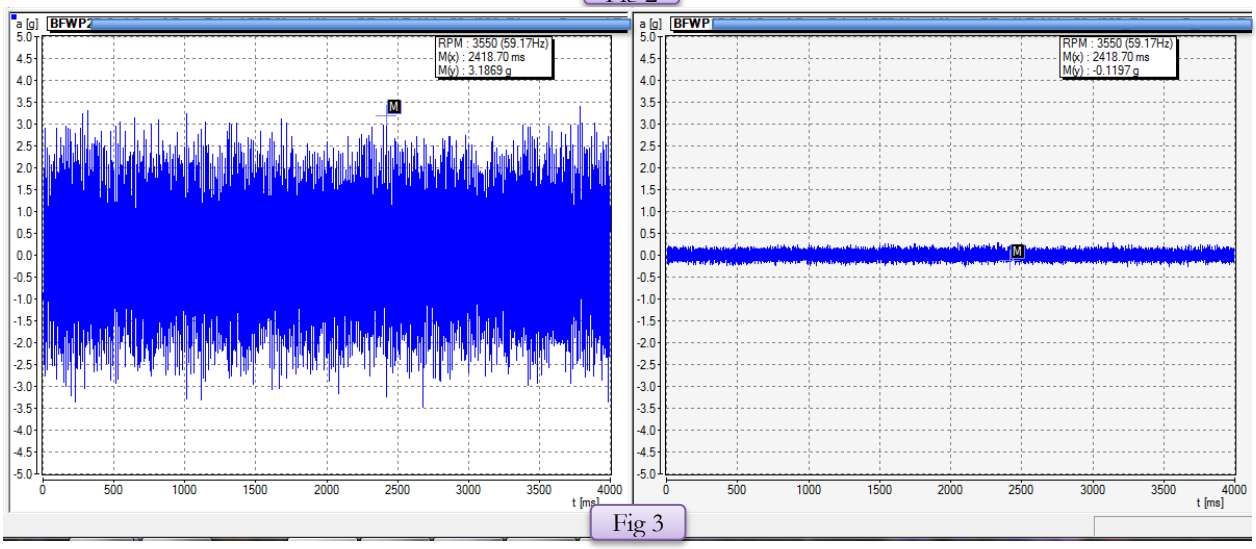

Fig 3

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The radial spectrums of this motor (the top four spectrums below in Fig 4) all show relatively low amplitudes of vibration, with the 1x and 2x peaks dominating (supporting the misalignment shown in the phase study). The inboard vertical (#3 down from the top) shows a raised noise floor from about the turning speed peak to pump vane pass (7x). This is most likely carried over from the pump.

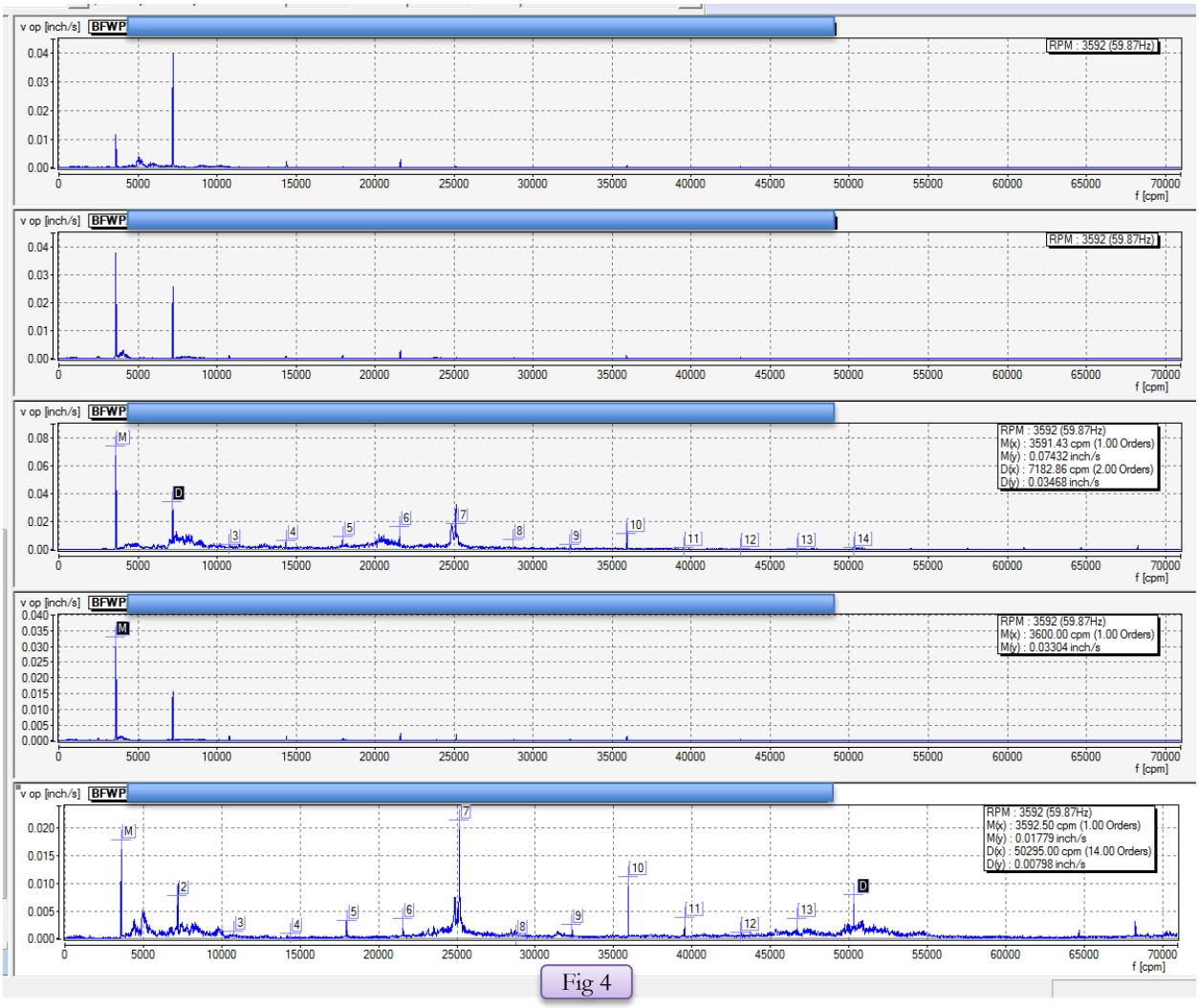

Fig 4

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The IBV on the motor shows numerous multiples of turning speed which most likely indicates bearing clearance or misalignment (Fig 5), but vertical phase data from the foundation up should be collected in the future to rule out machine looseness. This can be accomplished during routine periodic route data collection.

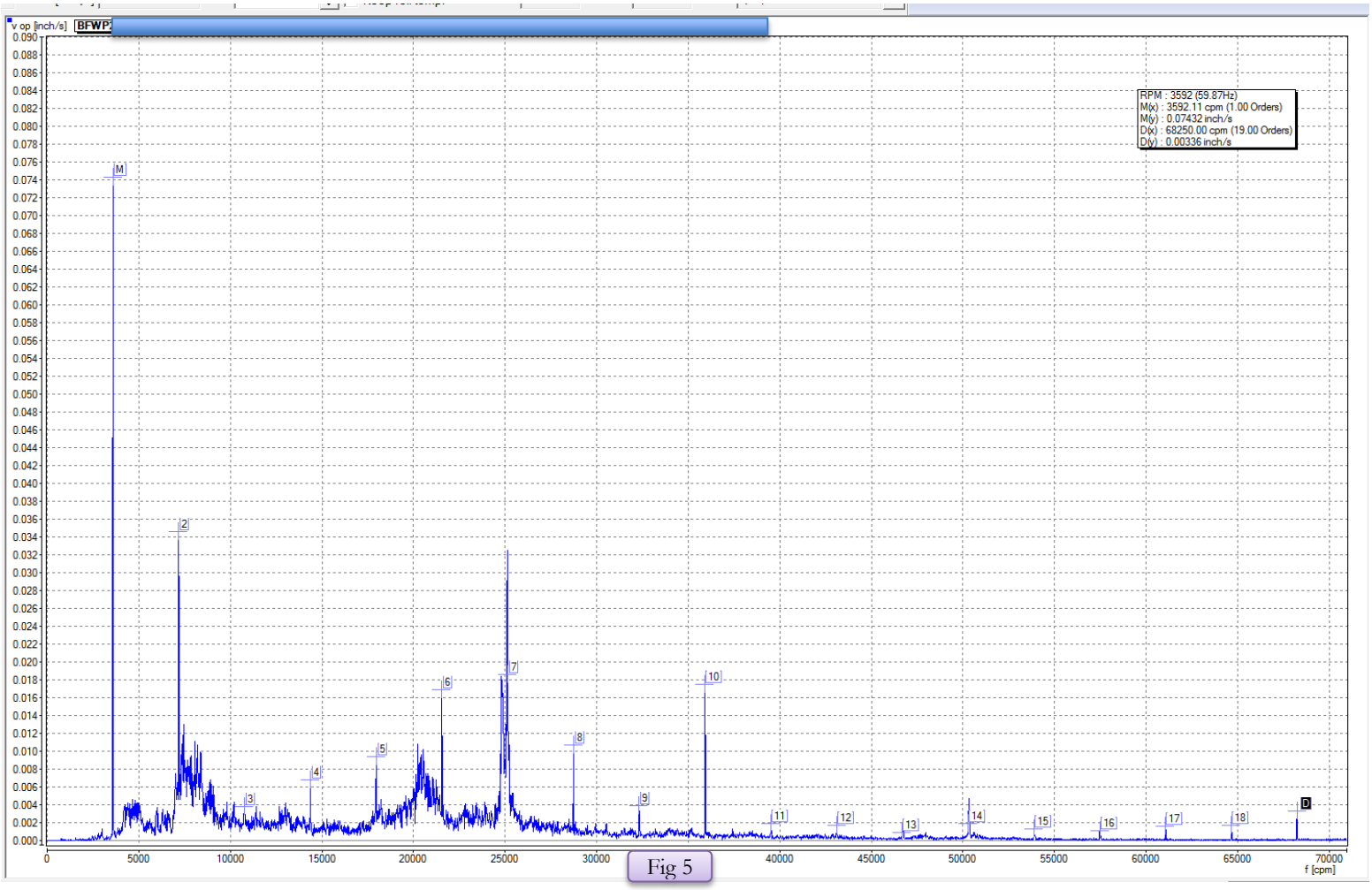

Fig 5

Recommendations for Boiler Feed-water Pump 1A motor:

1. Inspect coupling thoroughly, assuring proper lubrication.
2. Collect vertical phase data at the motor inboard vertical to rule out machine loosness.
3. Check clearances of the inboard bearing.
4. Check lube system. If regular oil analysis is not performed, have a representative sample analyzed.
5. Trend this condition (looseness) for early warning of a progressing defect.

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Boiler Feed-water Pump 1A_pump

The DE horizontal pump casing measurement is showing an area of raised noise floor (Fig 6) and mounding from about the 1x turning speed peak out to the 2nd harmonic of vane pass. This could indicate some suction cavitation. The 1x and 2x turning speed peaks are prominent indicating some residual misalignment and or unbalance. Prominent vane pass harmonics should be trended to determine if they indicate a developing fault condition.

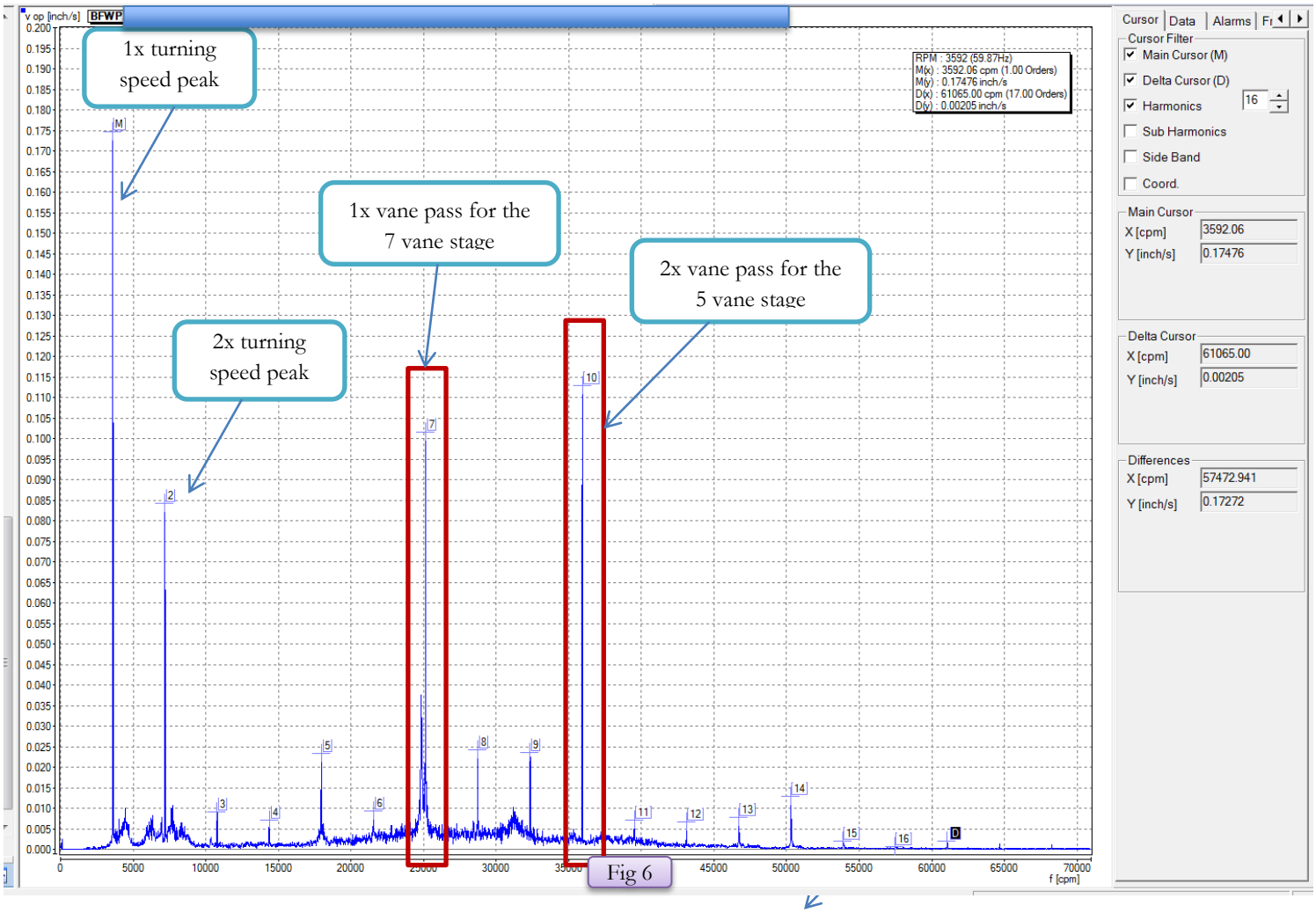

Fig 6

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The pump spectrums (Fig 7) all show the mounding from 1x turning speed out to vane pass frequency that often indicate suction cavitation. No single peaks are of sufficient amplitude to be alarming. The data needs to be trended.

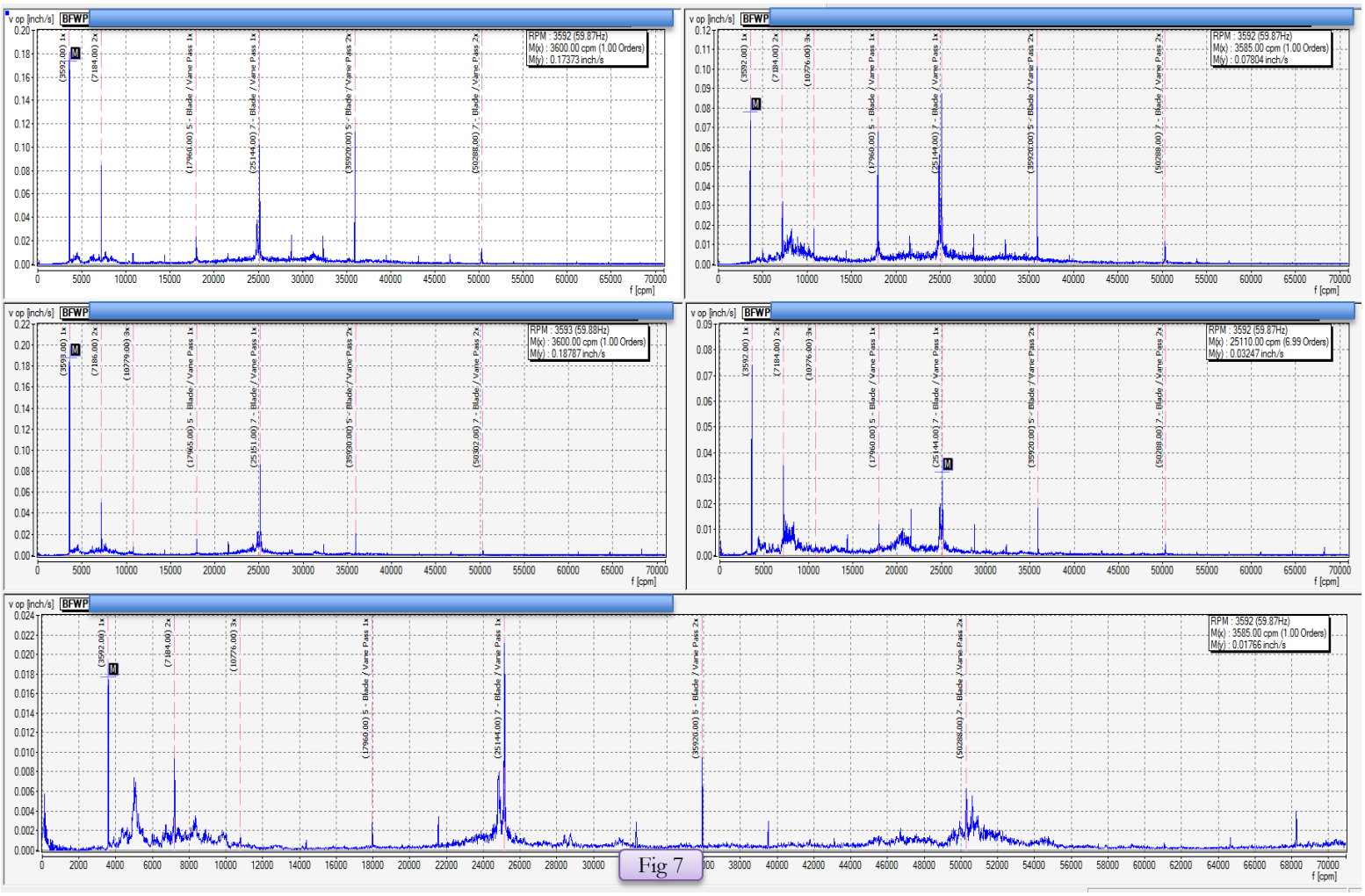

Fig 7

Recommendation for Boiler Feed-water Pump 1A_pump:

1. Check the suction screen, piping and valves to insure there is no restriction on the suction.

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Observations:

A peak very closely spaced (approximately 285cpm) to the fundamental of the 7 vane pass frequency was observed on most pump FFTs. The origin of this vibration is not known at this time. It would be prudent to take the next opportunity to collect coastdown data, which might help to identify the source of this peak.

The motor/pump combination exhibits some misalignment as revealed in the phase study. The amplitudes of vibration are not high enough for Ludeca to feel comfortable recommending the expense of shutting down the equipment to align it however; since the pump is presently shut down and there is a reasonably good possibility that the coupling is the source of the random high frequency axial vibration seen at the inboard of the motor, we do recommend that this coupling be thoroughly inspected and if the opportunity presents itself an alignment check would be prudent.

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Equipment ID	Drive Train	December 26th			Comments
	Power Block 1				
BFWP_1A	Motor	2			**Inspect coupling**. Check lube system. Check IB bearing clearances. Collect vertical phase data at the inboard of the motor down to the foundation to rule out mounting looseness. Check alignment. Trend
	Pump	2			Check suction screen and lines. Trend. Perform coastdown when possible
			Asset Health Legend:		
				1	Normal
				2	Warning
				3	Alert
				4	Discussion Needed
				NDC	No Data Collected
				RA	Recently Added

Thank you for allowing Ludeca and our partners to be of service to you.

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