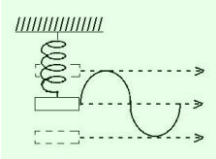

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21st Jan 2004

6237 Exhaust Fan

Dear Dave/Grant

I inspected the exhaust fan and found the following problems:

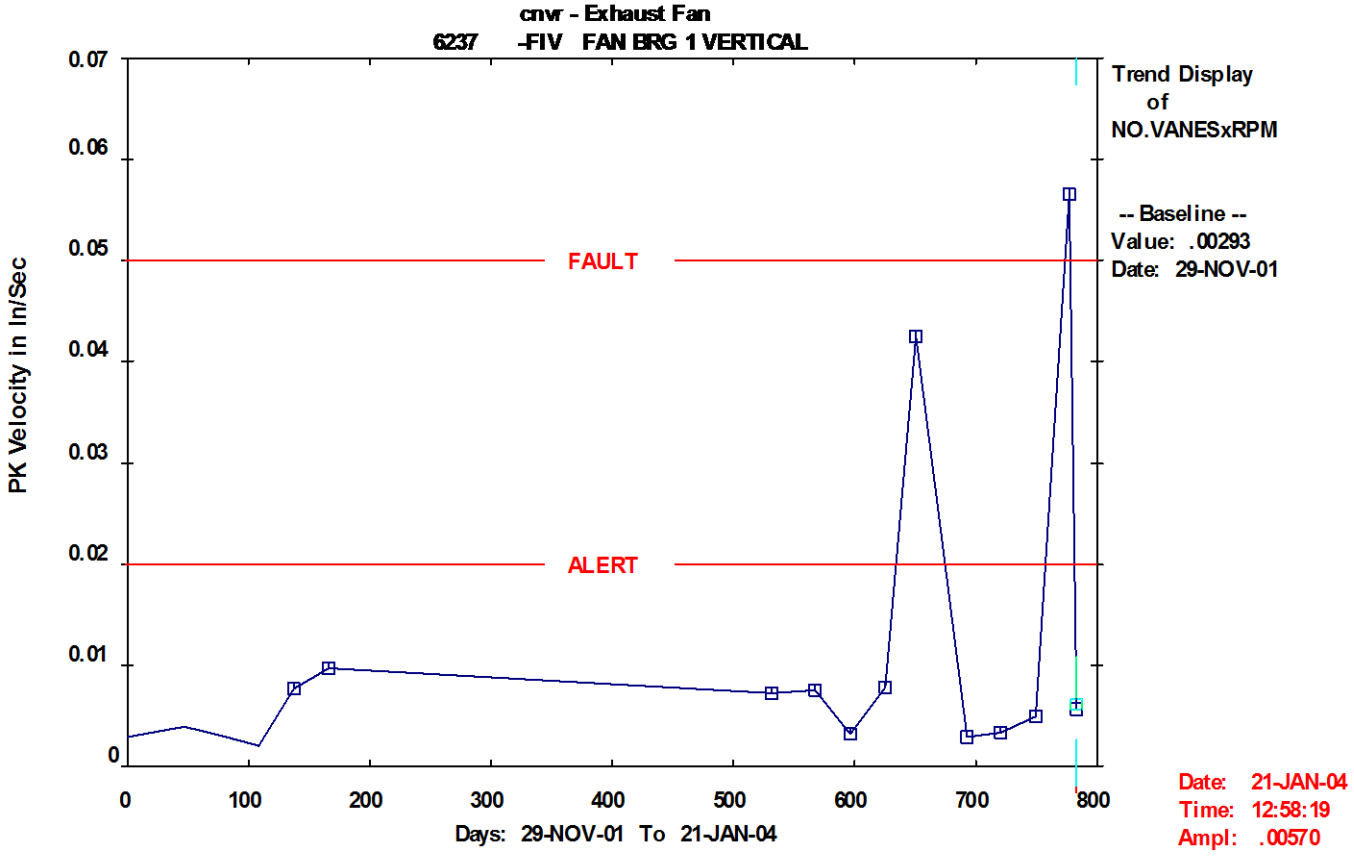
Inboard

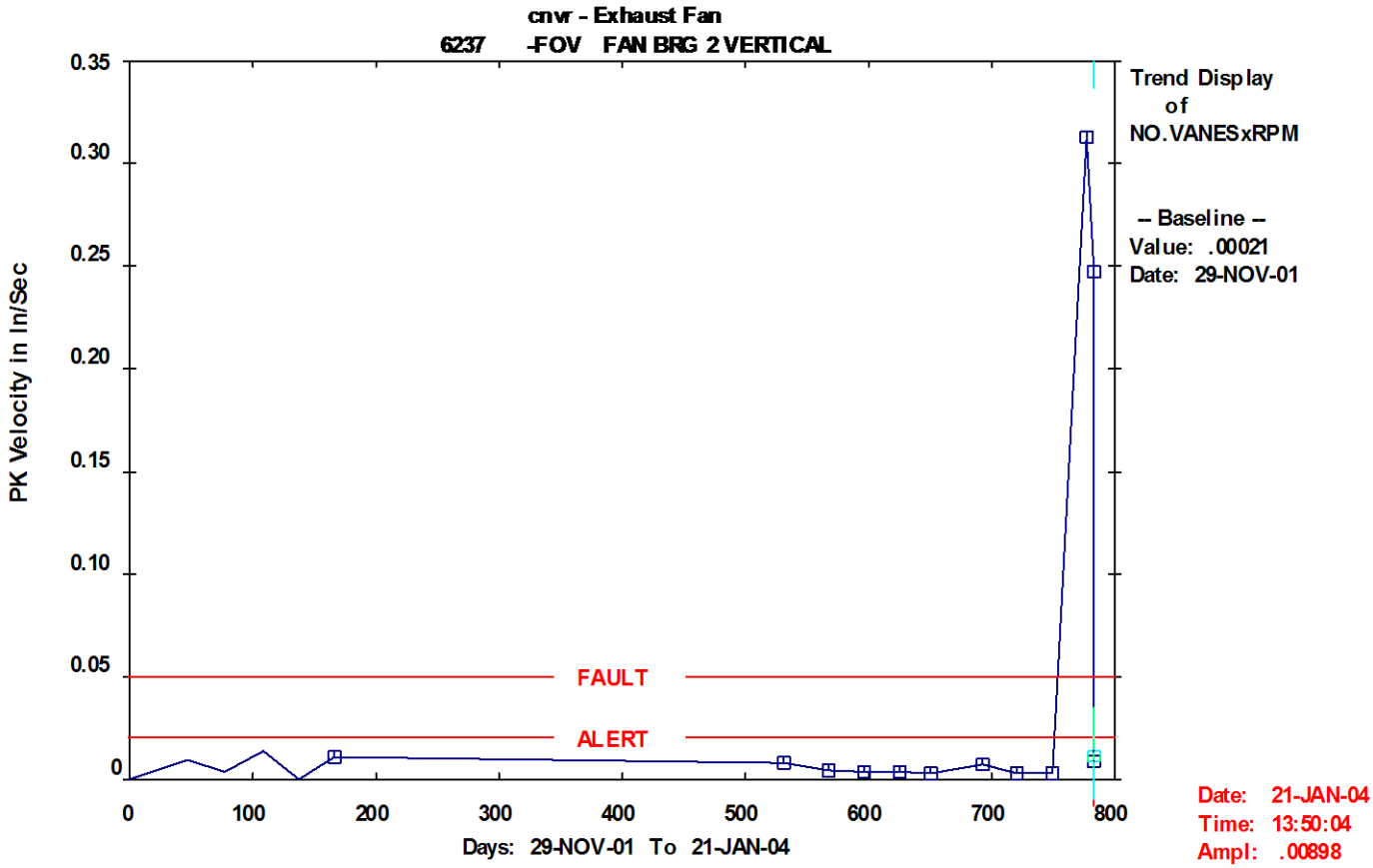
1/ The inboard fan bearing was installed the wrong way around, this did not cause any major problems but it prevented the temperature RTD probe from being located properly and operating effectively. There is a hole on one side of the bearing casting to locate the probe.

2/ The contact area of the bottom of the bearing was around 70% - with bluing and scraping I managed to obtain over 95% contact; the objective of this is to achieve a more consistent oil wedge and therefore better lubrication and extended bearing life.

3/ There was a lot of debris from the failure still in the bottom of the sump, this was either still in the sump after the repair or in the oil feed system.

4/ The shaft had dropped and rubbed on the pedestal casting when the bearing failed. This caused metal from the casting to be picked up and "cold welded" to the shaft. This had not been cleaned up when the bearing was replaced and was probably the cause of the "rubbing frequency" that I found on my monthly analysis. I managed to clean the shaft up using a flapper wheel but the pedestal casting bore could not cleaned up without dismantling fan housing and lifting the fan shaft. However, the indications from the trend plots below are that cleaning the shaft resolved the problem and eliminated the high frequency vibration issue.


cnvr - Exhaust Fan
6237 -FIV FAN BRG 1 VERTICAL
PK Velocity In In/Sec
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
FAULT
ALERT
0
100
200
300
400
500
600
700
800
Days: 29-NOV-01 To 21-JAN-04
Trend Display
of
NO.VANESxRPM
-- Baseline --
Value: .00293
Date: 29-NOV-01
Date: 21-JAN-04
Time: 12:58:19
Ampl: .00570


cnvr - Exhaust Fan
6237 -FOV FAN BRG 2 VERTICAL
PK Velocity In In/Sec
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0
FAULT
ALERT
0
100
200
300
400
500
600
700
800
Days: 29-NOV-01 To 21-JAN-04
Trend Display
of
NO.VANESxRPM
-- Baseline --
Value: .00021
Date: 29-NOV-01
Date: 21-JAN-04
Time: 13:50:04
Ampl: .00898

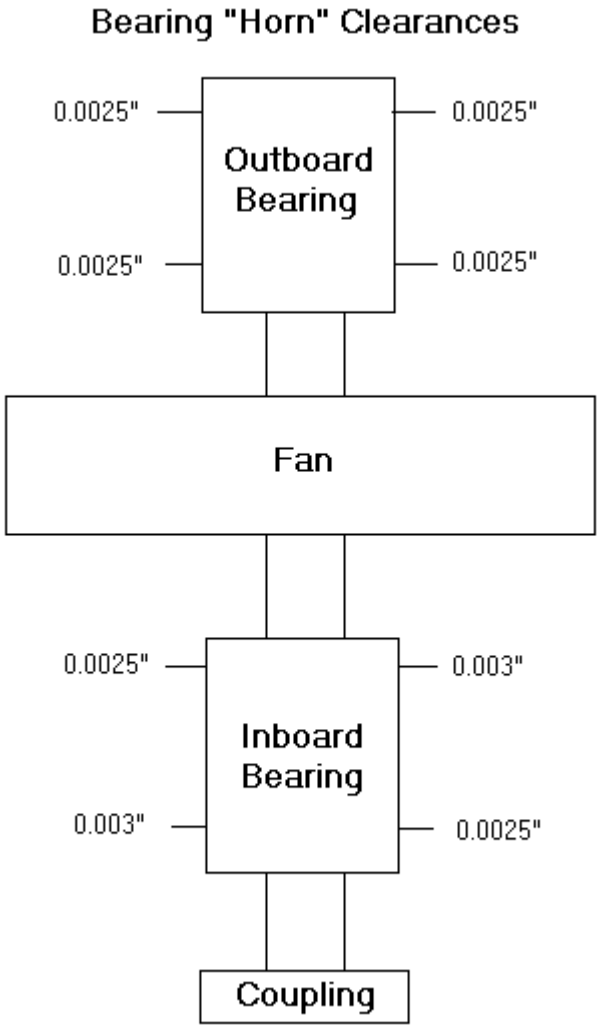
Outboard

5/ The outboard pedestal sump was very dirty – oil saturated coal dust could be scooped out by the handful.

6/ The shaft journal diameter was 0.001” to 0.0015” undersize which is still within spec’, the bore of the Babbitt bearing was 0.013” to 0.014” over the nominal shaft diameter. When new, the clearance should be 0.009”± 0.001” so we decided to replace the bearing.
For your information, excessive clearance in a Babbitt bearing can cause the oil wedge that the bearing rides on to rotate (Oil whirl) and cause vibration problems. In extreme cases if the “oil whirl” corresponds with the natural frequency of the rotor “Oil Whip” can occur, this could completely destroy a machine in a matter of minutes. If you might have seen the video clip of the suspension bridge twisting and turning until it collapses, this is the same phenomenon - In that case the wind speed excited the natural frequency of the bridge.

7/ The new outboard bearing was installed, blued and scraped and a contact area of over 95% was achieved. The internal diameter was also measured and found to be within specification.

8/ Horn readings (side clearance between the journals and bottom halves of the babbitt bearings), these are important to ensure good lubrication.



9/ The coupling alignment was checked with a laser alignment system, the equivalent "dial indicator" readings are as follows:

Peripheral readings: Top to Bottom - Motor is 0.021" low (Out of Spec)

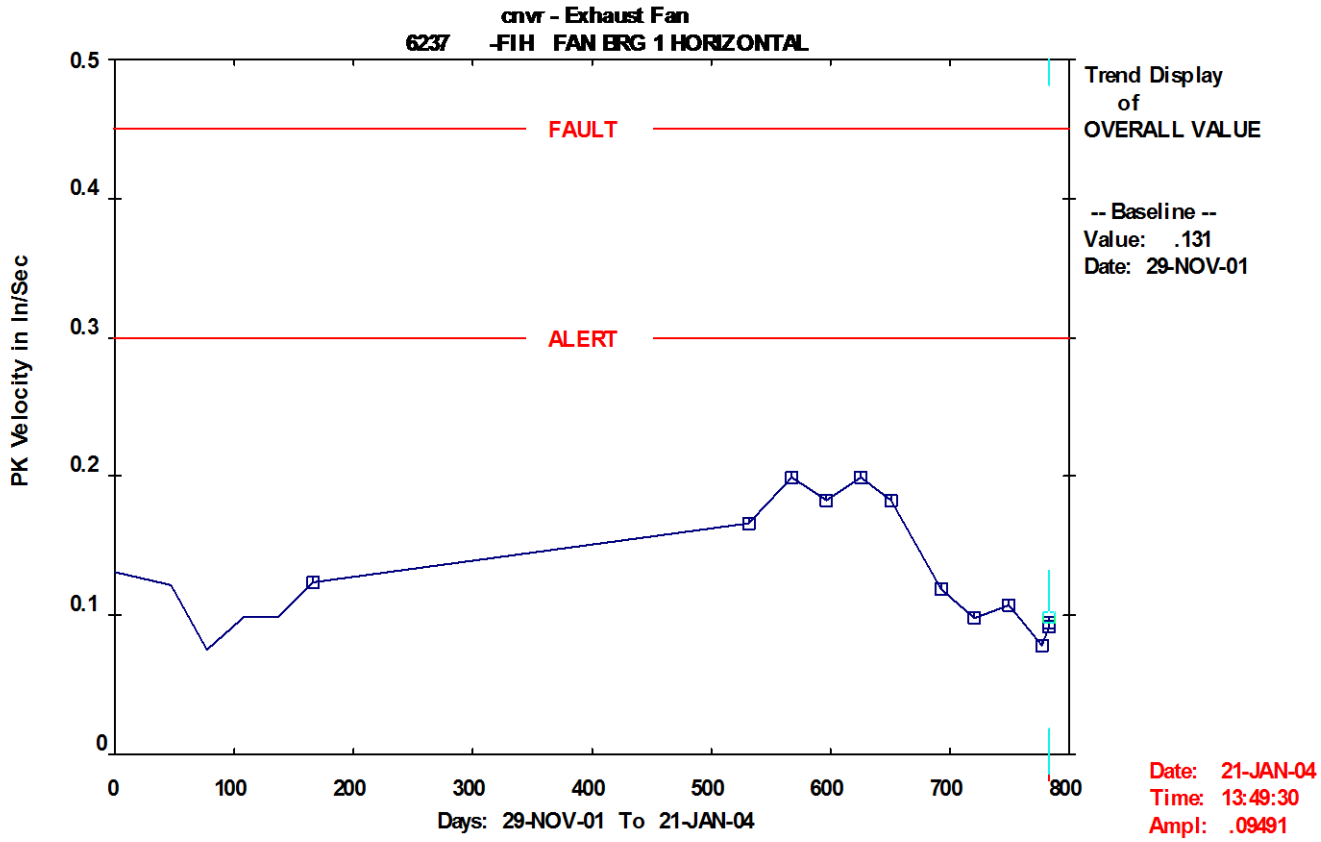
Motor should be 0.0025" high to allow for thermal growth in the fan.

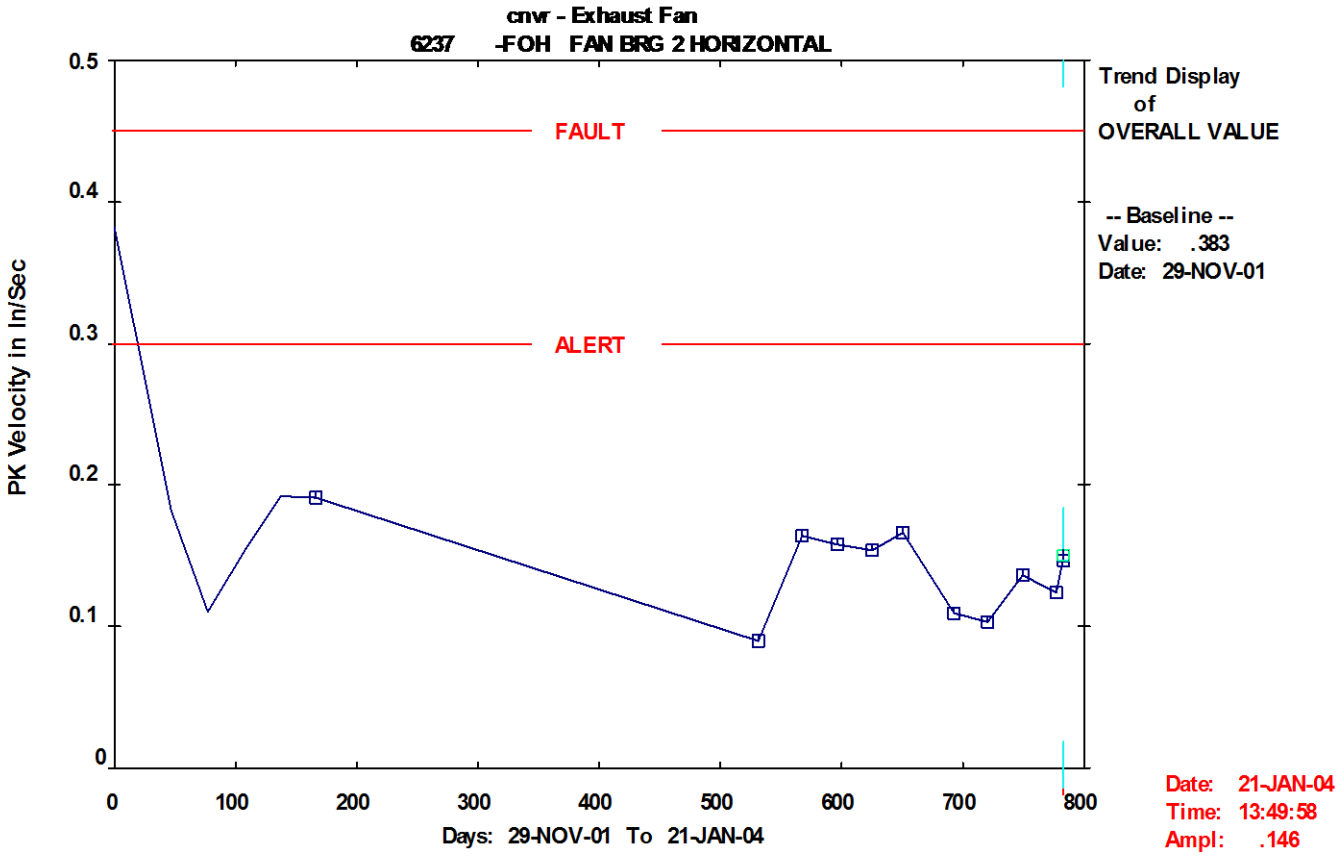
Side-to-Side – Motor is within 0.0014" (Within Spec)

Axial (Gap) Readings: Top to Bottom – The coupling is + 0.0069" at the top (Within Spec)
Side-to-Side – The coupling is open 0.0029" (Within Spec)

To get perfect alignment the motor inboard motor pedestal has to be raised 0.0255" and moved north 0.002"
The outboard motor pedestal has to be raised 0.0515" and moved north 0.012"

10/ I carried out a vibration analysis after the overhaul and the motor and fan appear OK and no "fault alarms were triggered.
The operator thought that the vibration levels appeared high, so I made two trend plots of the overall vibration in the horizontal direction on both fan bearings. These are in the same positions and measurement parameters as your fixed transducers – (I suspect that your transducers are measuring peak to peak, where as I am measuring peak velocity therefore your measurements will be double that of mine). The plots below do not indicate anything unusual from the normal trend.





Fan Bearing Temperatures after overhaul:

Both bearings are increasing at more or less the same rate; indicating that they are both seated correctly and rising along with the internal temperature of the fan. They should stabilize during the night - They are going to be checked every hour by your operator.

Time	Inboard Bearing	Outboard Bearing
Start Up	**71°F - 21.5°C**	**71°F - 21.5°C**
15 Min	**78°F - 25.5°C**	**79°F - 26°C**
30 Min	**78°F - 25.5°C**	**77°F - 25°C**
45 Min	**86°F - 30°C**	**86°F - 30°C**
1 Hr	**91°F - 33°C**	**91°F - 33°C**
1 Hr 15 Min	**94.5°F - 35°C**	**92.5°F - 34°C**
1 Hr 30 Min	**94.5°F - 35°C**	**92.5°F - 34°C**
2 Hours	**97°F - 36°C**	**96°F – 35.5°C**
2 Hr 30 Min	**98°F – 36.5°C**	**97°F - 36°C**
3 Hours	**101°F - 38°C**	**99°F - 37°C**
3 Hr 30 Min	**102°F - 39°C**	**102°F - 39°C**
4 Hours	**103°F – 39.5°C**	**103°F – 39.5°C**

Recommendations

1/ Ensure that the both temperature RTD's are working and that they will give both an alarm (65°C) and also trip the machine (80°C).

2/ Schedule annual inspections of the bearing pedestals.

3/ Inspect and Clean the motor pedestals, the contamination that I found in the outboard fan bearing is probably present in the motor bearing pedestals. This contamination is very abrasive and could account for the motor being 0.021" low i.e. the motor bearings are worn and may need replacing.

Estimated time to inspect, clean and if necessary replace the motor bearings = 2 Days (2 Men)

4/ Re-align the motor to the fan shaft. This may also incur a stator shift to maintain the rotor stator air gap integrity (the gap on this machine should be approximately 0.250" and be within ± 0.0125").

Estimated time to realign the motor to the fan = 2 Days (2 Men), 3 Days if the main stator and exciter need to be realigned

Note
Until the motor is inspected further it is difficult to know the full extent of work content and time involved; however, with extra help to remove and re-install the guards/covers it should be possible to complete all of the work outlined in recommendations 3 & 4 in 3 days.

5/ Repair or replace the oil lube system - The oil flow meter is defective, the return oil lines were disconnected to ensure that there was flow through the bearing pedestals but the meter gave an indication of no oil flow. Apparently this has been defective for over a year. It would also be prudent to have the flow meter trip the motor if flow is lost.

6/ A spare set of oil rings, pedestal gaskets and pedestal seals should be kept in stock.

I trust that the above is in line with your requirements but if you have any further questions please do not hesitate to contact me.

Regards: Rob Brentnall