



UTTER PRECISION, INC.

The Next Generation in Reliability

Utter Precision, Inc.

PO Box 337 • Utica, NE 68456-0337 • Phone/Fax 402-534-3513 • Mobile 402-641-7737 • Email info@utterprecision.com

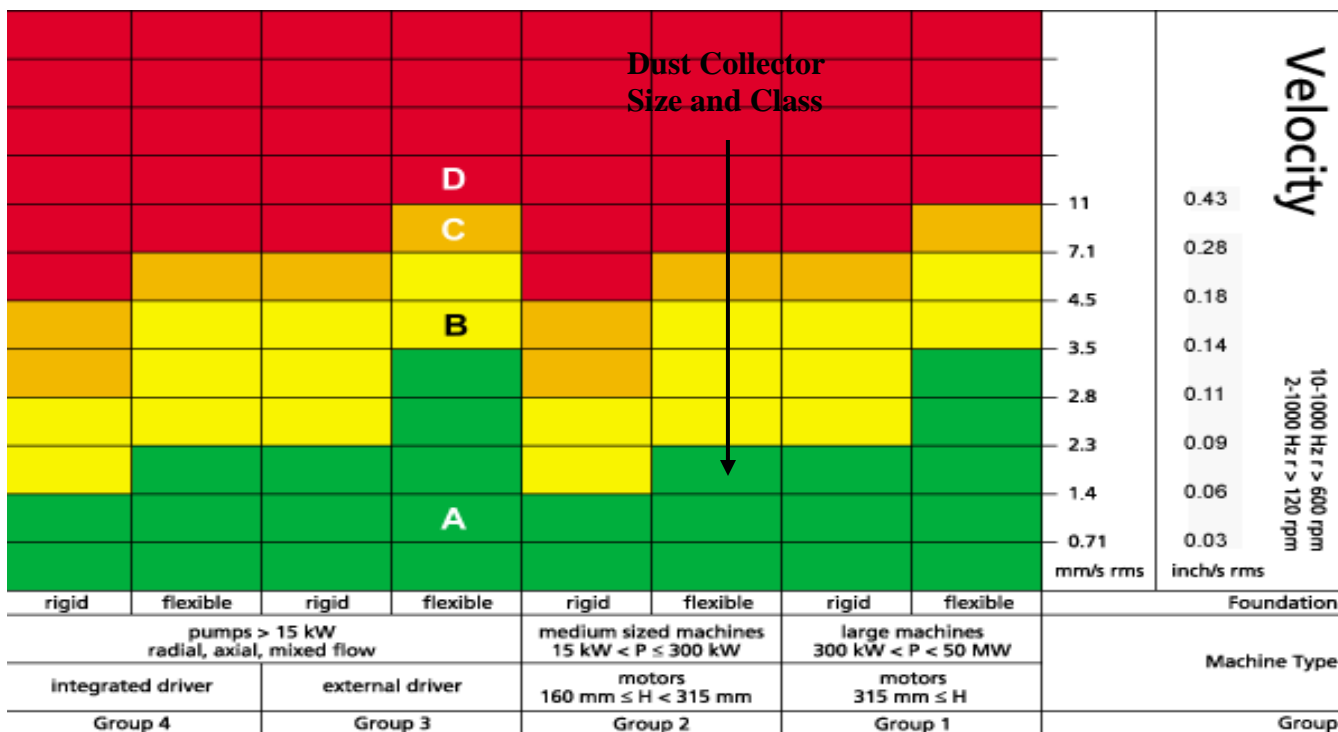
November 3, 2007

Manufacturing Company
 Attn: Maintenance Manager
 1234 Manufacturing Blvd
 Our Town, NE 68215

Subject: Plant Small Dust Collector Special Vibration Analysis

Dear Mr. Manager,

While performing the belt alignment training on November 2, 2007, we took ultrasonic, vibration, and infrared readings to show the value of using the laser alignment tools while at the Pawnee plant. Initially I noted a ticking noise in the drive end fan bearing with the VX ultrasonic gun, so I performed a vibration analysis to check the bearing condition and to show you the capabilities of the VSA-1215 Vibration Analyzer for troubleshooting. This system is based on a PDA palm pilot computer and used standard Microsoft Office Excel for its reporting function. Since there is not trending available we use the ISO 10816 Standard for vibration determining vibration severity. The graph below shows the **ACCEPTABLE**, **UNLIMITED LONG TERM OPERATION ALLOWED**, **SHORT TERM ALLOWABLE OPERATION**, and **DAMAGE CAUSING** levels with there corresponding ISO class. The unit is considered a Group 2 flexible piece of equipment as shown in the chart below. We also did infrared with the FLIR Infracam SD on the unit to show the value of using it to diagnose belt drive issues and to confirmation mechanical problems found with vibration.



- A** New machine condition
- B** Unlimited long-term operation allowable
- C** Short-term operation allowable
- D** Vibration causes damage



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Vibration Findings

The vibration on the fan showed numerous issues were present on the fan unit. I took vibration on the drive end bearing and found bearing faults present. We also found that the sheaves were misaligned.

The bearing wear is in Stage 2 of the bearing failure cycle and is considered to be at **Short Term Allowable Level** due to the type of vibration that is present. This is shown by Figures 1 & 2. Figure 3 & 4 show the before and after affects from the belt alignment that was performed.

Repair Recommendations

The belts were aligned and the bearings, sheaves, and belts were put on order but should be replaced when the next available opportunity arises. Until the replacement occurs ultrasonics and infrared can be quickly used to monitor the fan bearings. One of the maintenance guys used the ultrasonic gun to lubricate the bearings after the unit was started up and heard the levels on the bearing lower. This will allow the unit to run longer, but does not negate the need to replace the bearings.

I have also attached the infrared report showing how the alignment improved the issues found with it. Also attached here is the cost analysis with a rough guesstimate of the repair costs of the fan showing that with that one alignment you have already paid for the unit and training. This does not include an downtime costs due to the fact that this is only the small dust collector fan.

Return on Investment for Scheduled Repair vs. Unplanned Repair			
Example Cost Analysis Sheet for the Dust Collector Fan			
The Following is Sample Return on Investment shows the Vaule of Using Reliability Based Maintenance Tools Save Valuable Bottom Line Profits in Your Company			
	Estimated Cost for Repairs Made with Equipment in Current Condition	Estimated Cost for Replacement after Complete Failure	Saving for Immediate Repair
Material	\$1,167	\$3,500	\$2,333
	Estimated Cost of Man Hours Necessary to Make Repair with Equipment in Current Condition	Estimated Cost for Man Hours Required if Repairs are Made After Complete Failure	
Labor	\$520	\$780	\$260
Estimate Unplanned Downtime	\$0	\$0	\$0
Total Savings for Performing Maintenance Actions Now:			\$2,593
Disclaimer: The listed prices are based on estimates. The repair costs do not include environmental hazard fines or damages that occur to other equipment as a direct result of the primary failure. This also does not include loss due to Power Consumption,			

1. Input the name of a critical equipment:	Dust Collector Fan
2. Input the replacement cost of that piece of equipment:	\$3,500.00
3. Input the time (in hrs) to remove & replace that piece of equipment:	4.00
4. Input the number of technicians required for repair or replacement:	2
5. Input the cost attributed to maintenance repair actions (per hour):	\$65.00
6. Input the cost of downtime for the area in which the equipment is located:	\$0.00
7. Input the estimated time (in hours) required to receive a replacement piece of equipment after complete failure (include lead time and shipping time):	

I thank you for the opportunity to begin the culture change within your plant and to improve the overall quality of life by improving safety, profits and potential.

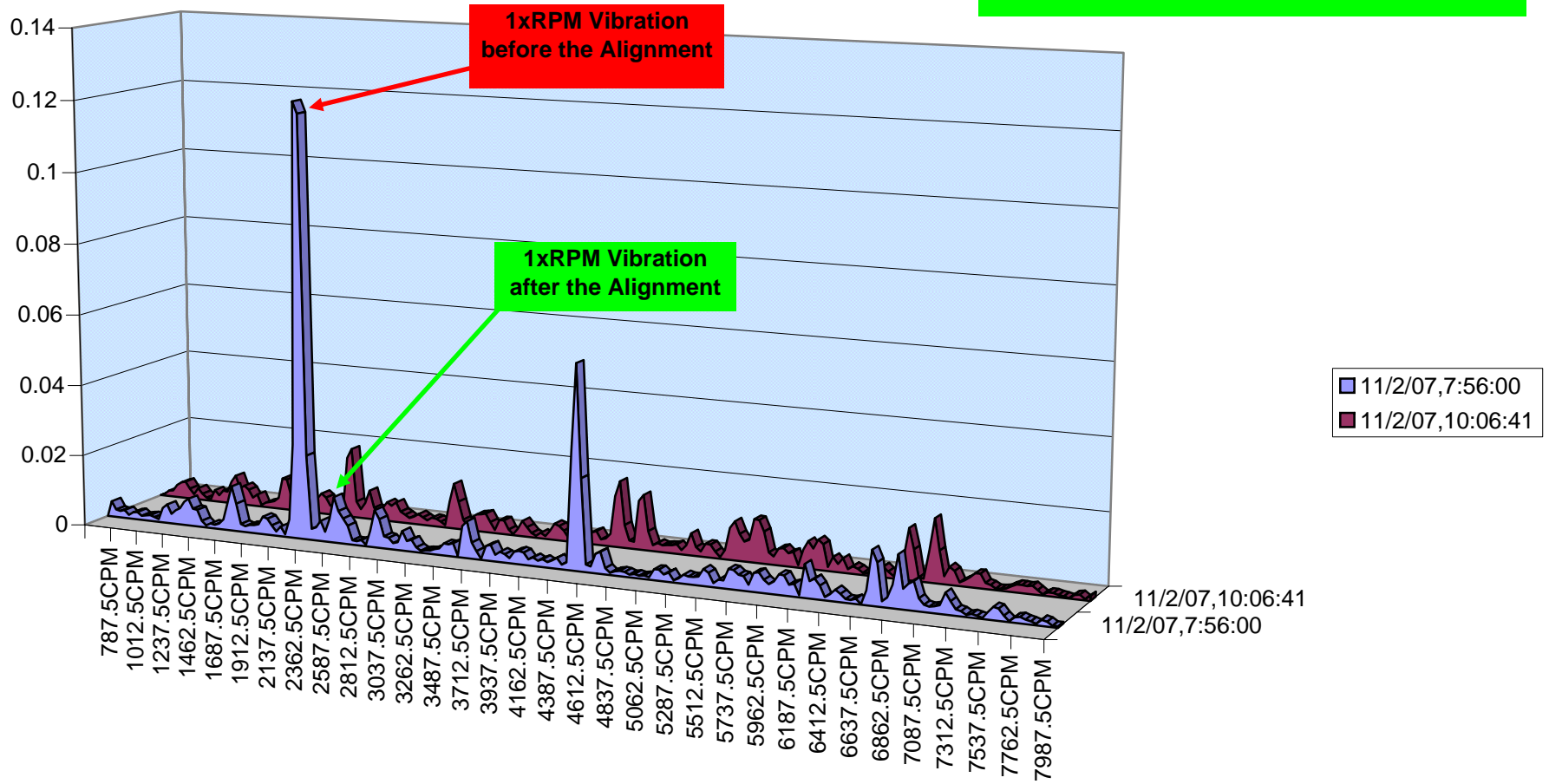
Godspeed!
 OJ Utter
 President
 Utter Precision, Inc.
 oj@utterprecision.com



DCF-ia (in/s rms)

Waterfall Graph of DCF-ia

Vibration Levels on the Fan Unit improved significantly from the 7:56am reading in Blue which is before the alignment to the 10:06am reading in Purple after the alignment. Note the change in the 1xRPM peak shown by the arrows.



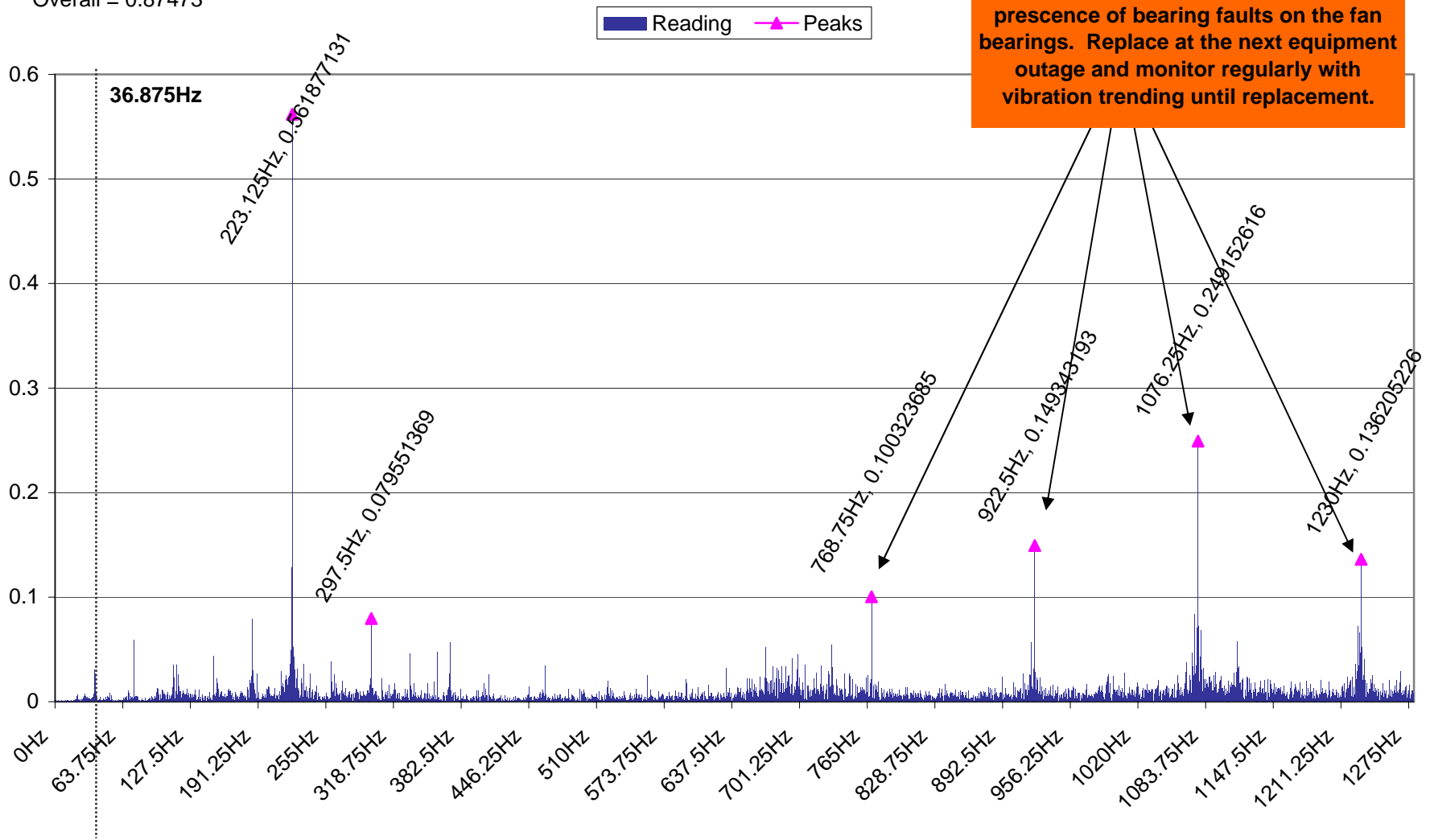


Acceleration
DCF-ihw (g) rms
Overall = 0.87473

Spectrum computed from wave data of

DCF-ihwW 11/2/07,7:51:36

Bearing numbers are unknown but the spacing of these peaks is 153.75Hz which is 5.72xRPM (1xRPM of the fan is 2212.5RPM or 36.875Hz). This and the impacting in the waveform shows the presence of bearing faults on the fan bearings. Replace at the next equipment outage and monitor regularly with vibration trending until replacement.





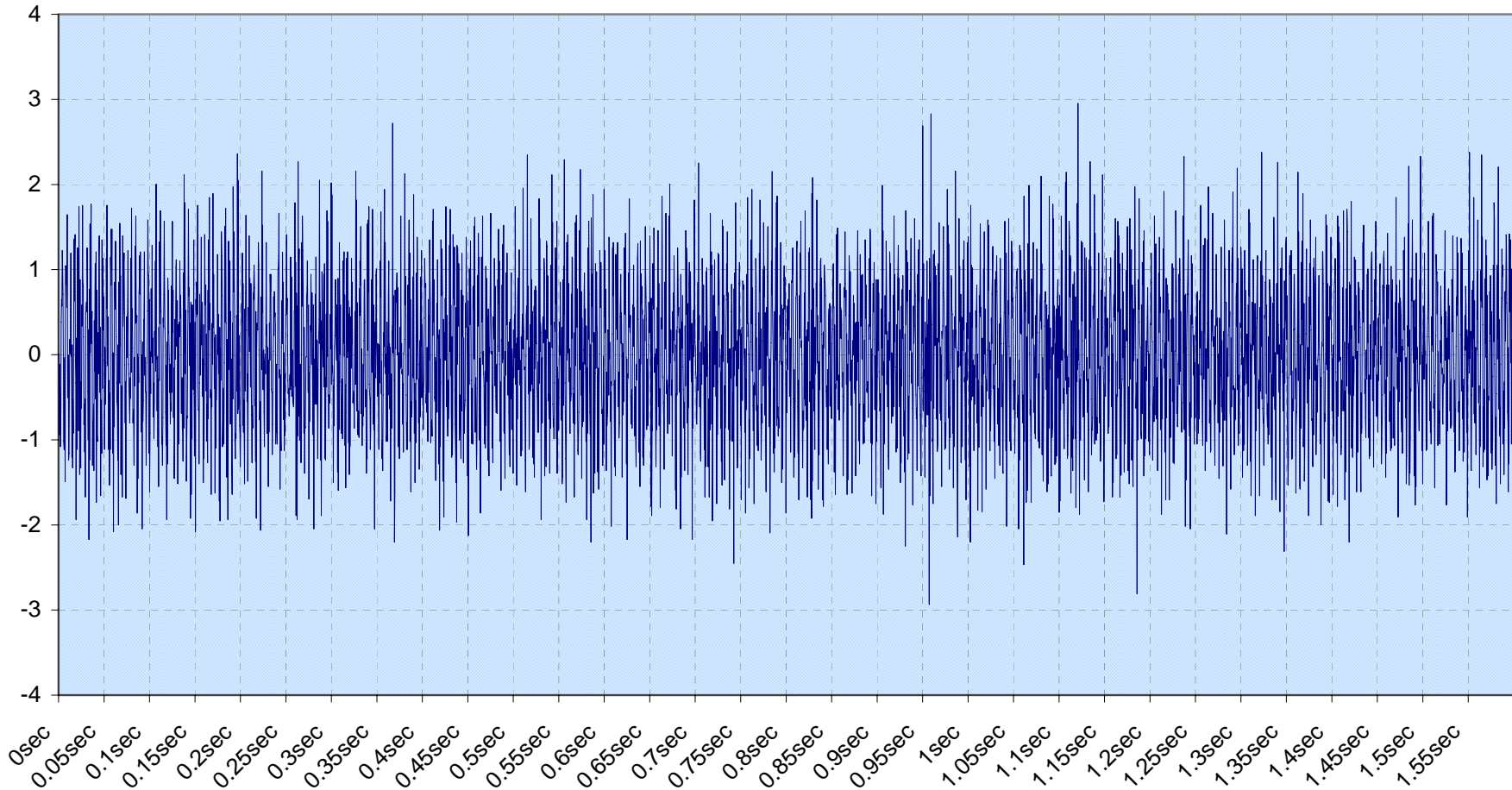
DCF-ihw (g)
Acceleration
Overall = 0.87501

Waveform Capture

DCF-ihwW 11/2/07,7:51:36

— Measurement

Figure 2 shows the Peak to Peak Impacting of almost 6 G-s in the waveform is of concern but indicates that there is still life left in the bearings. Since the spectrum shows that the vibration is impacting is likely due to inner race defects the bearing should be closely watched until the replacement of the bearings

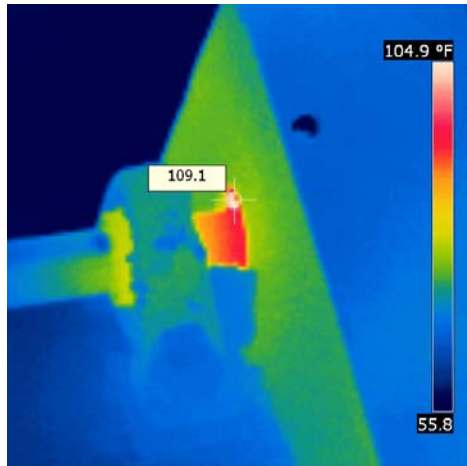


Report Date 11/3/2007

Company Utter Precision, Inc.
Address PO Box 337 Utica, NE 68456

Thermographer OJ Utter

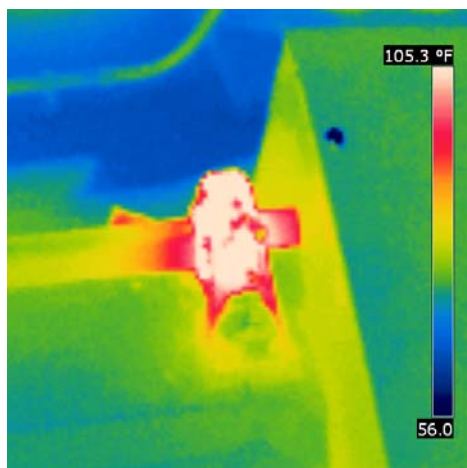
Customer CB Manufacturing Company
Site Address 555 E St Uptown, ST 66633
Contact Person Phil Man



Camera Model	FLIR InfraCAM Wester
Image Date	2007:11:02 20:54:09
Image Name	IR_0467.jpg
Emissivity	0.92
Reflected Temperature	40.0 °F
Object Distance	6.6 ft

Description

Heating of the Fan Sheave shown by the spot which indicates belt slippage. Also present is heating of the inner race of the bearing.



Camera Model	FLIR InfraCAM Wester
Image Date	2007:11:02 23:09:22
Image Name	IR_0464.jpg
Emissivity	0.92
Reflected Temperature	54.0 °F
Object Distance	6.6 ft

Description

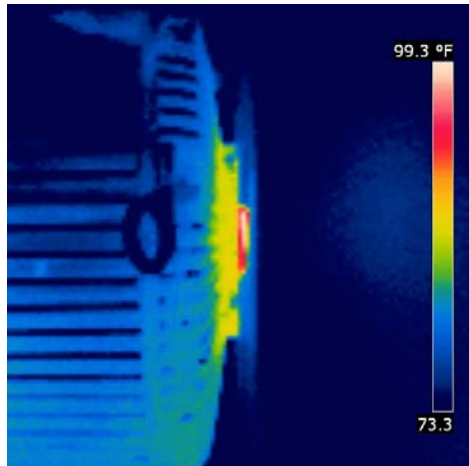
Heating of the bearing now is higher than that of the fan sheave. Also note that the heating goes from the bearing to the sheave instead of the other way due to the proper alignment. The bearing is hotter because it was just lubricated.

Report Date 11/3/2007

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Address PO Box 337 Utica, NE 68456

Customer CB Manufacturing Company
Site Address 555 E St Uptown, ST 66633
Contact Person Phil Man

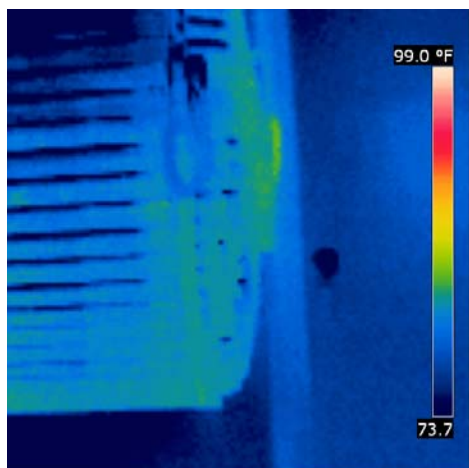
Thermographer OJ Utter



Camera Model	FLIR InfraCAM Wester
Image Date	2007:11:02 20:54:21
Image Name	IR_0465.jpg
Emissivity	0.90
Reflected Temperature	40.0 °F
Object Distance	6.6 ft

Description

The Dust Collector Fan Motor showing the presence of heating of the drive end bearing which indicates a sheave misalignment issue is present.



Camera Model	FLIR InfraCAM Wester
Image Date	2007:11:02 23:09:08
Image Name	IR_0468.jpg
Emissivity	0.92
Reflected Temperature	54.0 °F
Object Distance	6.6 ft

Description

The after alignment picture showing the decrease in the load of the drive end shaft bearing.