Early Detection of Belt Failure
Case Study A1

Location: AA Electric Lakeland, FL

Condition: Detection of Belt Breakage

Machine:

A Test system designed to measure bearing failure. The Assembly, figure 1 consists of two identical motors, powered by one VFD, spinning identical shafts each suported on two identical pillow block bearing sets. The goal of this assembly was to first gather good base line data between both fixtures. Then the intent was to induce bearing failure on the Test fixture while the Control fixture was left alone. Vibe-Sight was to record responces to the abused bearing and the control bearing.

Since these fixtures were not spinning a heavy load, a simple V-belt and pulley araingment was used to drive the shafts.

Figure 1
Test Assembly

Vibration sensors were placed with the Z axis pointing down through the shaft with the X axis pointing out from the bearring detecting thrust changes.

The first thing noticed on starting the system was that Vibe-Sight detected **significantly more X axis vibration on the Control Fixture had than with the Test Fixture**. So much so, that it was decided to take a closer look at the assembly. It turned out the the Control fixture motor had a faulty front bearing. This was rectified and the tests were started.

The motors were logged for 30 days after that time analytics were started. This allowed proper weighting of the data. Data recoriding started 9/1/21. See the data and Halos below:

Health Data
Table 1

Name	Date	Health%	Halo
Node 5 Control Bearing	9/1/21	100%	
Node 5 Control Bearing	9/17/21	100%	
Node 5 Control Bearing	9/26/21	78%	
Node 5 Control Bearing	9/30/21	50%	
Node 5 Control Bearing	10/1/21	38%	
Node 5 Control Bearing	10/2/21	34%	
Node 5 Control Bearing	10/3/21	30%	
Node 5 Control Bearing	10/4/21	5%	

When the Health Halo dropped to 78% on 9/26/21, an internal algorithm issue was suspected.

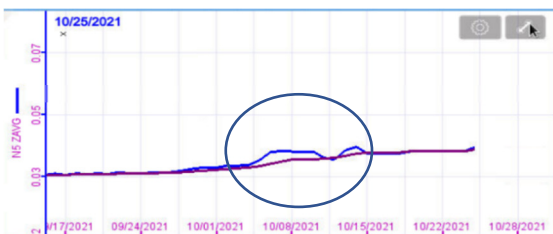A quick look at the formulas showed everything was working as expected.

When the Health Halo dropped to 50% on 9/30/21 the assembly was inspected and **belt breakdown** was found on the Control Fixture.

Like bearing failure, belt failure will occur rapidly. To see what would happen and how well Vibe-Sight would perform it was decided to let the breakdown occur.
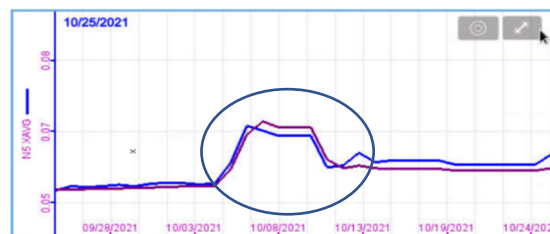
Vibe-Sight has a feature called Dynamic Tracking this is triggered when the vibrational energy increases at an aggressive rate. The test group saw this as a great way to test both the **Machine Heath calculations and Dynamic Tracking**.

As can be seen in table 1, **Machine health degraded at an aggressive rate**. This is what we would expect with **belt failure**. The night of 10/4 our Dynamic tracking kicked in and dropped our Machine Health to 5%. See figure 2 to see the effect of the belt on overall Normalized Vibration Energy.

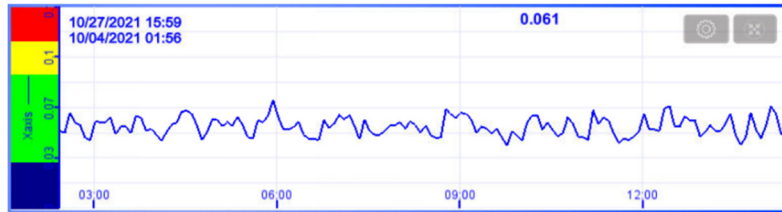**Figure 2**
Normalized Vibration Energy

Dynamic Tracking did not kick in on the Z axis.   Dynamic Tracking did kick in on the X axis.

Of interesting note, the Vibration levels did not reach or exceed the Warning Alarm set points. Figure 3 shows the effect of the belt breakage on the Realtime Vibration curves.
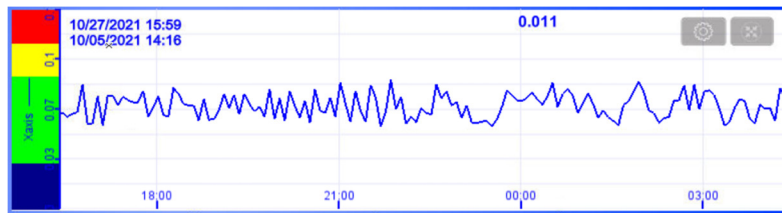
Figure 3
Realtime Curves
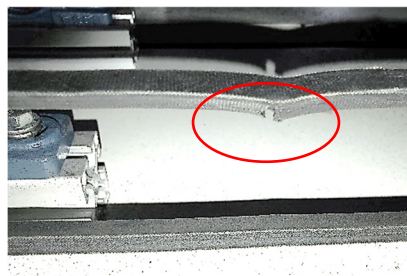

Event Log Prior to Belt Breakage

Event Log During Belt Breakage

Event Log After Belt Breakage

Figure 4 shows the final belt failure. Note, the belt did not separate since there was minimal load on the system. This allowed the fixture to continue to operate with viable data.

Figure 4
Belt Breakage

When Machine Health reached **30% an ETBF Warning alarm** was generated. When Machine Health reached below **15% a Critical ETBF Alarm** was generated. These were sent out as email alarm indications.

This machine had Health Warnings 5 days in advance. During this time the vibration signal did not reach the warning level. **This failure would have been missed with the traditional vibration alarms**. With Vibe-Sights Health Halo the facility would have been warned 5 days in advance.

For more information read "Predictive Maintenance Made Easy" and "Using Predictive Analytics to Forecast Failure" for a discussion on using Predictive Analytics in Vibe-Sight.