



Bearing indication on a high speed separator after close to 48 000 hours in operation

In a brewery a separator had been running almost 48 000 hours when MIVA® Master detected acute spindle bearing condition. Because of the early warning service could be carried out without loss of production.

Result

- ✓ Possible to run the component 800% longer than supplier recommendation
- ✓ Only make service when needed and not based on operating hours
- ✓ Lower maintenance costs and higher availability.

Solution

- ✓ Online condition monitoring
- ✓ Automated alarm tuning
- ✓ Standard Machine Module with criteria's for approx. 120 values – both for vibration and other process values
- ✓ MIVA® Master with the Software PEMAC for Condition Monitoring.

Challenge

- ✓ Running the machine as long as possible without jeopardizing the production
- ✓ How to predict non-linear fault occurrences
- ✓ Implement condition based maintenance

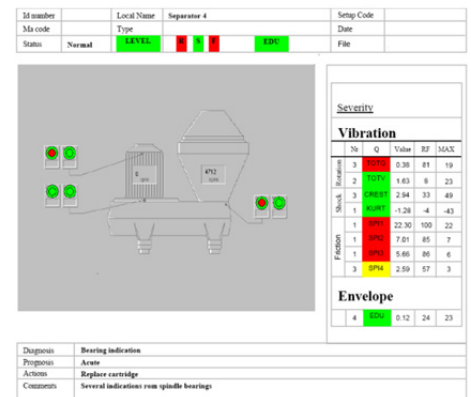
The operators got indication from the MIVA® system that an acute spindle bearing condition had occurred July 8th. The system had identified symptoms from outer ring damage and ball damage on bearing 6315. Replacement of the spindle cartridge was automatically suggested by the system. Because of the early warning service could be carried out without loss of any beer production. The cartridge was replaced July 21st and the separator resumed normal condition.

The spindle bearings were sent for investigation by the bearing manufacturer. A report from the manufacturer confirms that the outer ring and one ball was damaged on the 6315 bearing and that the bearing had been in service longer than its service life. All other bearings were in relatively good condition considering the long time in service.

Indications from MIVA® Master

The first warning on Separator 4 was given by the MIVA® monitoring system June 28th. The situation was not considered acute at this time but we decided to follow development more closely.

One week later, July 8, the system had detected acute condition and identified distinct symptoms from damaged spindle bearings. A report was issued with recommendations to replace the spindle cartridge. This report is shown below.



Symptoms were mainly seen on the 6315 and 7315BE spindle bearings. The defective bearings were highlighted with red in the K-model report. The picture below shows the K-model report from July 18 with comments on how it should be interpreted.



More Information

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VIKON is a global supplier of Smart Condition Monitoring Solutions and Rotor Balancing for all kinds of machinery. Our systems and products are found in many different Industries, in more than 20 countries worldwide. We have been helping our customers for over 30 years in achieving the best possible Overall Equipment Effectiveness(OEE) and Asset Management(AM).

Statement on bearing condition

Bearing	Statement by bearing manufacturer
6315 (Bearing 1)	The bearing has spalling damages and has been in service longer than its service life. Spalling was found on one ball and at two spots on the outer ring. Corrosion was found on almost all surfaces.
7315BEM1 (Bearing 2)	The bearing was found to be in relatively good condition regarding the running time of 30000 hours [1]. Generally there are discolorations and some indentations on the balls and raceways. There is a slightly grayish path pattern in the raceways.
NU2214 (Bearing 3)	The bearing was found to be in relatively good condition regarding the running time of 30000 hours. Generally the raceways are discolored and some shattered surfaces in transversal direction. There is a slightly grayish path pattern in the raceways from wear and there is fretting corrosion.
NU2214 (Bearing 4)	The bearing was found to be in relatively good condition regarding the running time of 30000 hours. Generally the raceways are discolored and some shattered surfaces in transversal direction. There is a slightly grayish path pattern in the raceways from wear. Fretting corrosion. Generally the bearing exhibits minor wear. There are some discolored surfaces and there is fretting corrosion.

[1] After above statements was made we received new information indicating the separator had been in operation over 48 000 hours.

The spindle cartridge continued to operate for another two weeks after the report was submitted. It was replaced July 21st after being in service almost 48 000 hours.

K-model report

Class	Element	Position	Symptom	RF	RMS	RF=0	Match	Base Freq
BFG	6315	Neck upper	18PFO	100.0	0.2235	0.0191	5	245.263
BFG	7315BE	Neck lower	BSF2M	98.0	0.1571	0.0244	1	255.432
BFG	6315	Neck upper	BSF2	87.0	0.1456	0.0199	2	327.083
BFG	7315BE	Neck lower	18PFO	84.0	0.1095	0.0162	1	360.500
SHAFT	A03-30001	Motor	18MUL	25.0	0.2036	0.0729	8	59.717
ABSDTOR	A02-24000	Motor	18MUL	8.0	0.2106	0.0965	1	59.628
BOVAL	-	Boval	18MUL	5.0	0.6271	1.0849	1	78.811
SEPHOLD	R08-1-01	Drive unit	18RES	3.0	0.0489	0.3715	1	95.842
SHAFT	R08-1-001	Spindle	18MUL	3.0	0.1095	0.0803	3	79.524
BELT	L2000	Ball	18MUL	3.0	0.1136	0.0812	3	17.596
BFG	7315BE	Neck lower	38PFM	2.0	0.0312	0.0237	1	950.377

The K-model used in the MIVA® system identifies fault sources in the machine and lists them by the distance from normal. Symptom highlighted with red are the most likely ones. The following explains the results.

6315: Vibration (rms) from the outer ring (BPFO) is about 12 times above normal (RF=0). Five frequencies matched the symptom. Vibration from ball defect (BSF2) was 7 times above normal. Two frequencies matched this symptom.

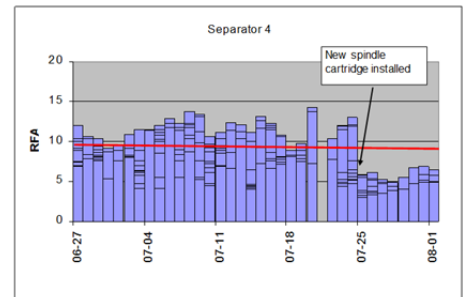
7315BE: Vibration from the outer ring (BPFO) was about 6 times above normal. One frequency matched this symptom. Vibration energy from ball defect was only seen as a modulation from the cage (BSF2M). This was about 7 times above the normal. One frequency matched this symptom.

RFA Trend

The RFA value measures the "distance" from normal condition. The bigger the number is the further from normal condition the machine is. The RFA value increases regardless of the fault source

causing deviations from normal condition. Limit values have been calculated statistically by using data from a large population of machines of the same type.

Support for our decision to recommend change of cartridge is that we had observed a drastic change in machine condition in June relative the condition at the beginning of the year. The diagram show RFA values before and after the cartridge was replaced.



The red line is the upper limit for normal condition. Each bar represents RFA values over one day. Variations over the day is shown with a horizontal line inside the bar.

The level dropped significantly below the red line after the cartridge was replaced.

The bearings were sent to the bearing manufacturer for a statement on the bearing condition based on the assumption that bearings had been in operation 30000 hours. Conclusions made by the bearing manufacturer are given in above to the left.



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