CASE STUDY

HD Technologies Case Study:
Press roll bearing damage detection

Paper Machine K25,
Vrancart SA, Romania

by

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1 Introduction

This case study describes online shock pulse and vibration measurements taken from a press roll bearing in the paper machine K25 at Vrancart S.A. in Romania, one of the most notable producers of corrugated cardboard, paperboards and tissue papers in the country. The total of finished pulp and paper/paperboard products are approx. 80.000 tons/year.

The paper mill is currently investing in upgrades of the K25 paper machine, aiming to increase its working speed. An important part of achieving this is having a reliable system for online condition monitoring in place.

At the moment, the online SPM system Intellinova monitors 264 measuring points in the press section and five drying sections in this paper machine.

The subject of this case study is the drive end bearing on the lower roll on the drive side of Press №2. This is a large and very expensive bearing working under high load, and continuous monitoring is thus essential.

2 Conclusion and summary

The online system installed on this part of the paper machine consists of eight Intellinova Standard units and one Intellinova Compact. The prewarning time for the bearing problems described in this case study was about six weeks.

From the beginning of the measurements on the press roll, starting on July 1st, 2016 until September 17th, 2017 there were visible frequencies in the SPM HD Spectrum matching the BPFO bearing symptom. The amplitude, however, was low: HDm/HDc = 1 / -10 dB.

From September 17, 2017, a small but stable increase in the shock pulse levels (HDm/HDc = 8 / -12 dB) was noticed.

On October 16, 2017, there was a second, more rapid increase and levels raised to HDm/HDc = 27/-11 dB. At the same time, in addition to the BPFO symptom, frequencies matching the BPFIM bearing symptom also appeared in the SPM HD Spectrum.

On October 30, 2017, the shock pulse levels reached HDm/HDc = 45/-11 dB, while the vibration levels remained low.

On November 2nd, 2017, the paper machine was stopped for investigation, and the bearing was replaced due to a visible crack on the inner race.

During the specified time, vibration levels did not rise at all, and the vibration spectrum did not show any signs of bearing damage. As can be seen in Fig. 22, the RMS levels did not show much, but with HD ENV quite good results were achieved. When comparing readings with the different measuring technologies, it can be seen that SPM HD and HD ENV Filter 4 showed very similar results.

The cause of this bearing failure was most probably the extra high load on the press.

On the bearing outer race, there were visible traces of rust and small spots which could be the source of the BPFO symptom before the inner race crack. The bearing was under warranty, and the client called the bearing manufacturer for revision and investigation of the cause of the failure.

Thanks to the long pre-warning time and planned bearing replacement, the customer saved at least 10.000 Euro.

The bearing number is 23280.

3 Application description

In the paper machine, the wet fiber web passes between large press rolls loaded under high pressure in order to squeeze out as much water as possible.

Figure 1. *Paper machine press rolls.*

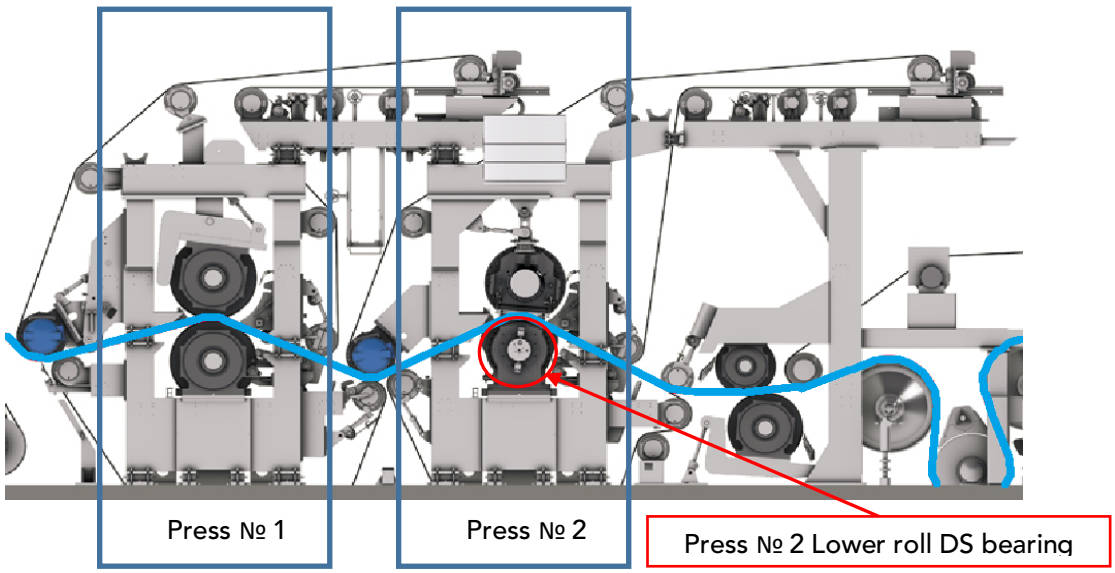
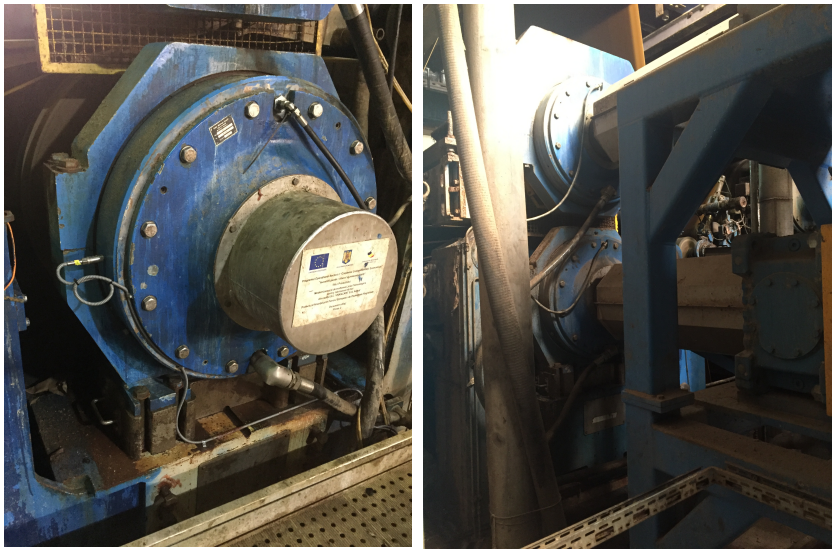


Figure 1 shows a principle view of the paper machine press section. The paper goes through two consecutive presses and continues to the drying section. The speed varies from 80 to 110 RPM.

***Image 1**. Paper machine K25, Press №2, lower roll bearings on the drive and work sides, respectively.*



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4 System setup

4.1 Measuring equipment

Online system:	Intellinova Compact
Vibration sensor:	DuoTech
RPM sensor:	Proximity switch

4.2 Measuring techniques

The measuring techniques used are the SPM HD shock pulse tecknology, EVAM vibration, and HD ENV, Filters 3 and 4.

4.3 Condmaster setup

Settings used in Condmaster Ruby 2018.2.1:

Measuring technique SPM HD:

- Measuring time: Same as FFT measurement
- Short/long time memory: Time signal and FFT
- Upper frequency: 100 Orders
- Lines in spectrum: 3200
- Symptom Enhancement Factor (SEF): 3
- Max RPM: 200
- Min RPM: 50

Measuring technique EVAM:

- Short/long time memory: Time signal and FFT/Full Spectrum
- Time signal unit: ACC
- Spectrum unit: VEL
- Order tracking: Yes
- Upper frequency: 80 Orders
- Lower frequency: 2 Hz
- Lines in spectrum: 3200

Measuring technique HD ENV, Filter 3 (500 - 10 000 Hz) and Filter 4 (5000 - 40 000 Hz):

- Short/long time memory: Time signal and FFT
- Upper frequency: 100 Orders
- Lines in spectrum: 3200
- Symptom Enhancement Factor (SEF): 3
- Max RPM: 200
- Min RPM: 50

5 Case description

Measuring point Lower Press Roll Drive Side - PU2-VI - DE

5.1 SPM HD measurement results

Figure 2. *SPM HD trend graph HDm/HDc, from August 2016 to November 2017.*

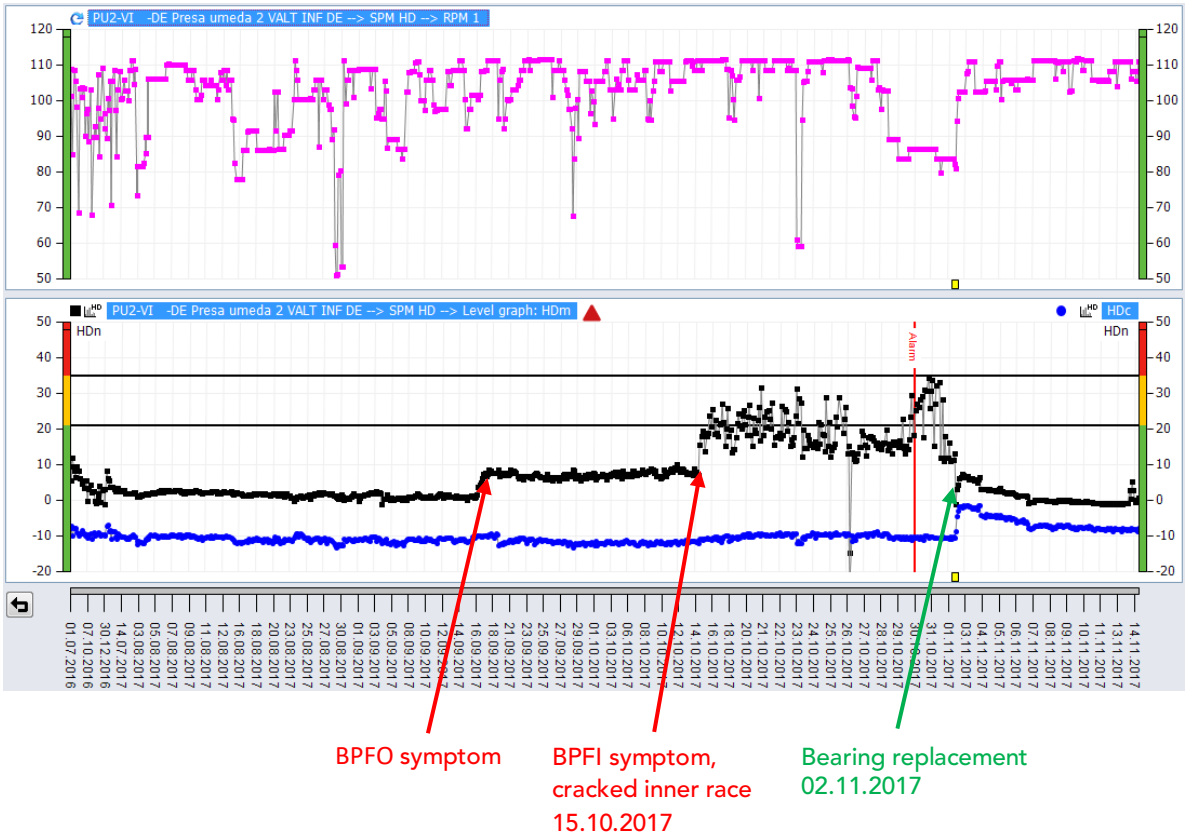


Figure 3. *SPM HD Bearing Symptom trend graphs - August 2016 to November 2017.*

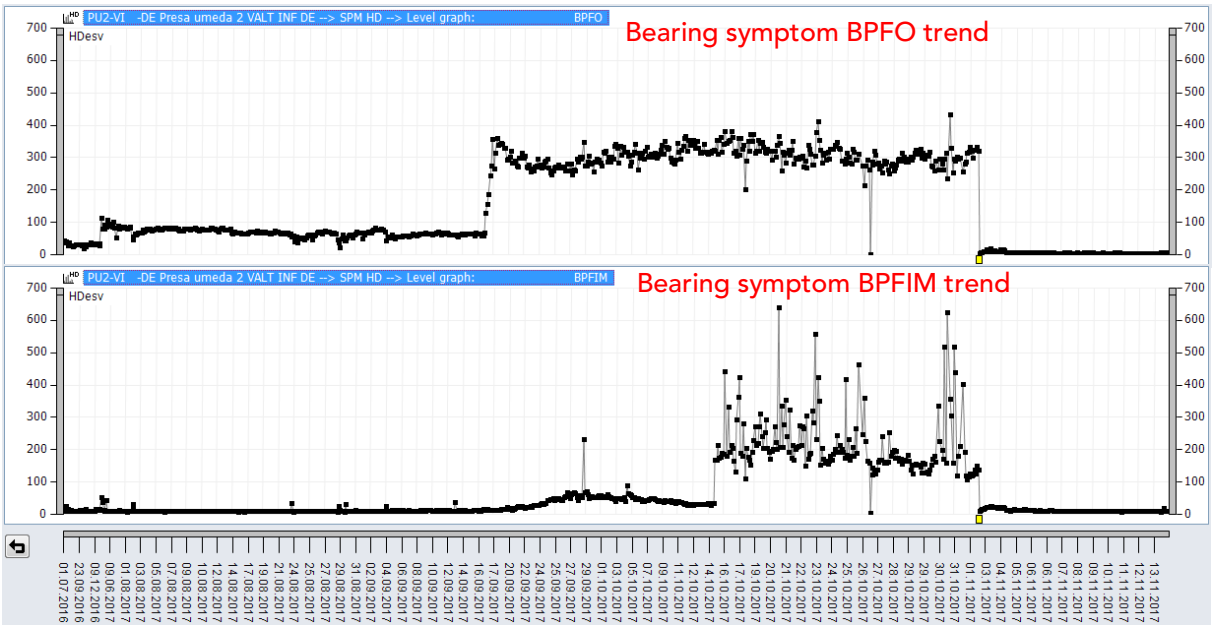


Figure 4. *SPM HD Spectrum before inner race crack - Press №2, lower roll bearing DS, BPFO symptom.*

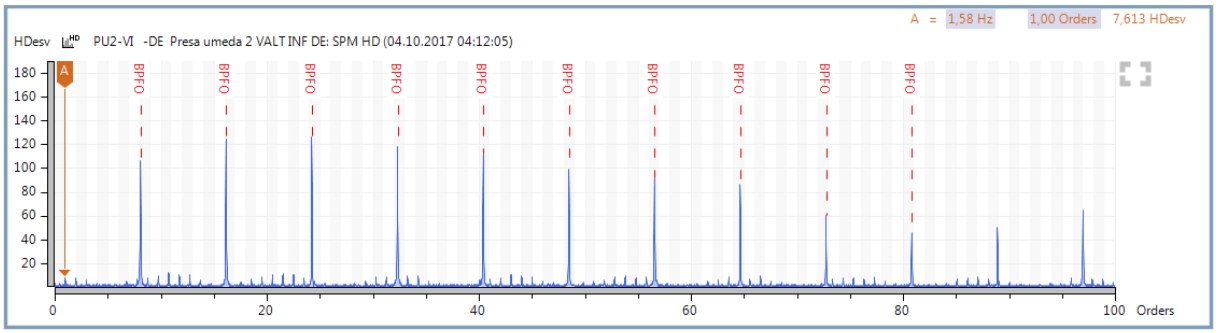


Figure 5. *SPM HD Spectrum after inner race crack - Press №2, lower roll bearing DS, showing BPFO and BPFIM symptoms.*

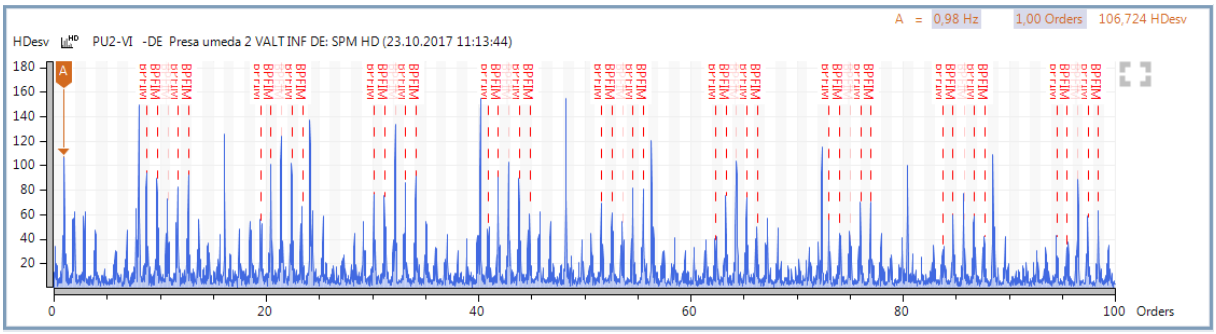


Figure 6. *SPM HD Time signal and circular plot before inner race crack - Press №2, lower roll bearing DS.*

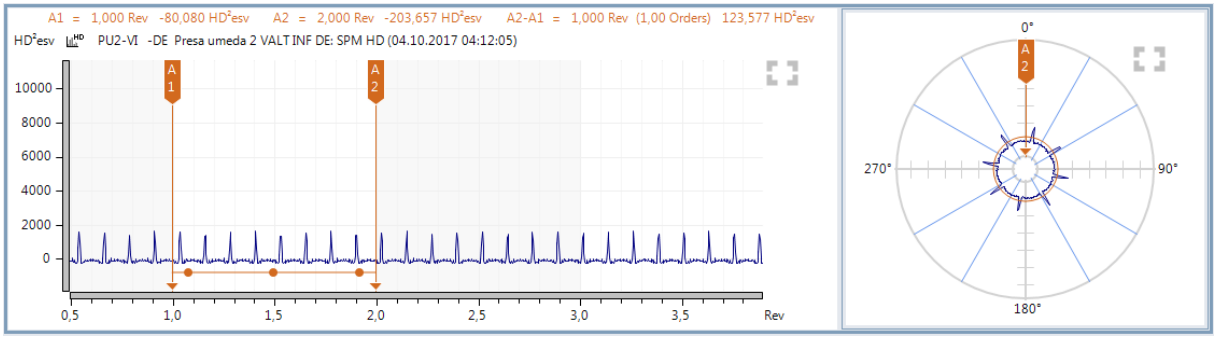


Figure 7. *SPM HD Time signal and circular plot after inner race crack - Press №2, lower roll bearing DS.*

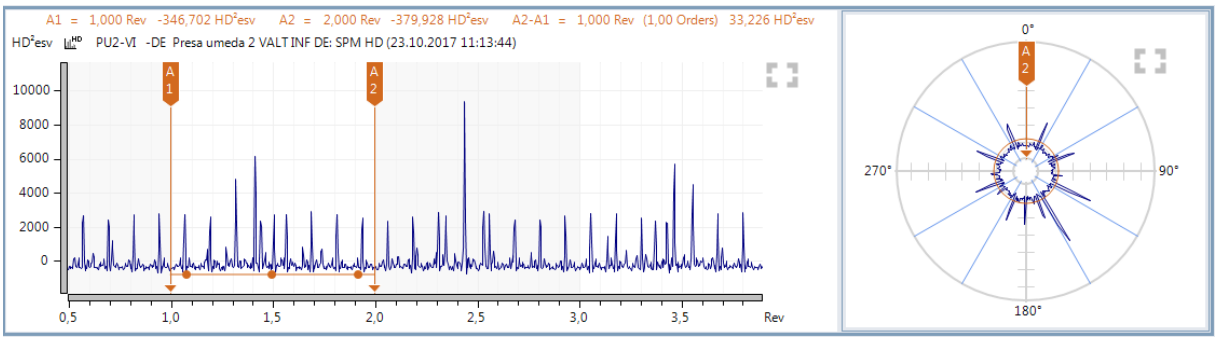
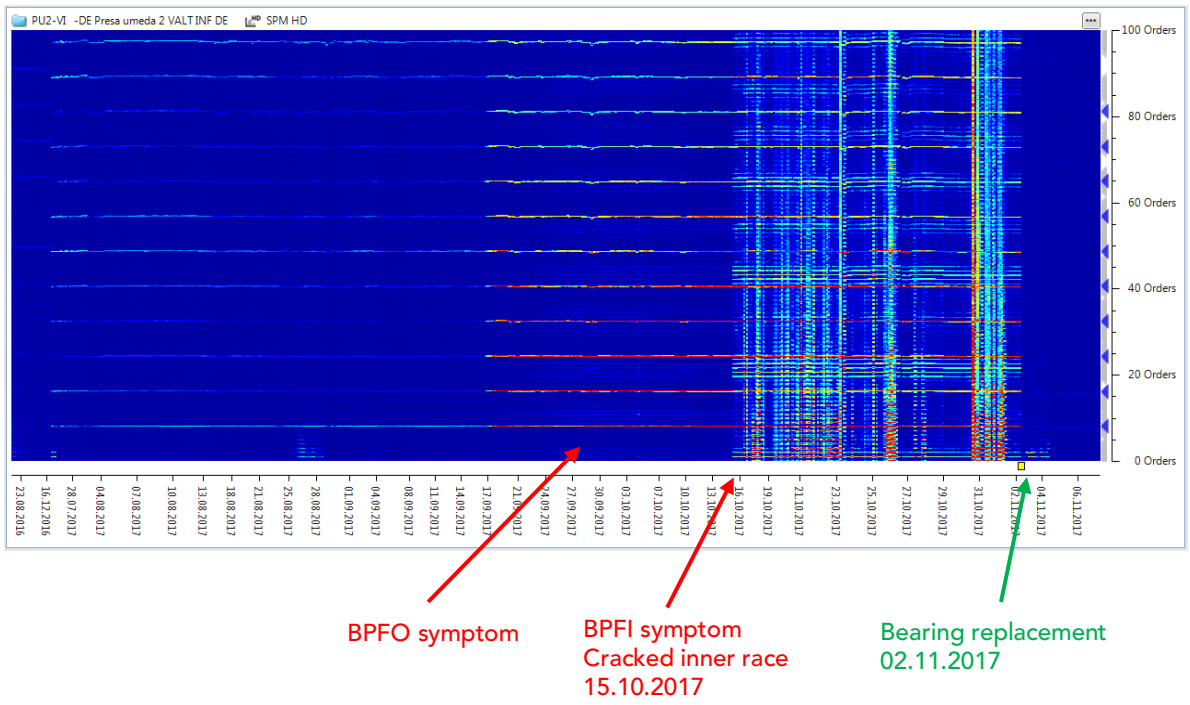


Figure 8. *SPM HD Colored Spectrum Overview from August 2016 to November 2017.*



5.2 HD ENV measurement results

Figure 9. *HD ENV - Filter 3 trend graph, from August 2016 to November 2017.*

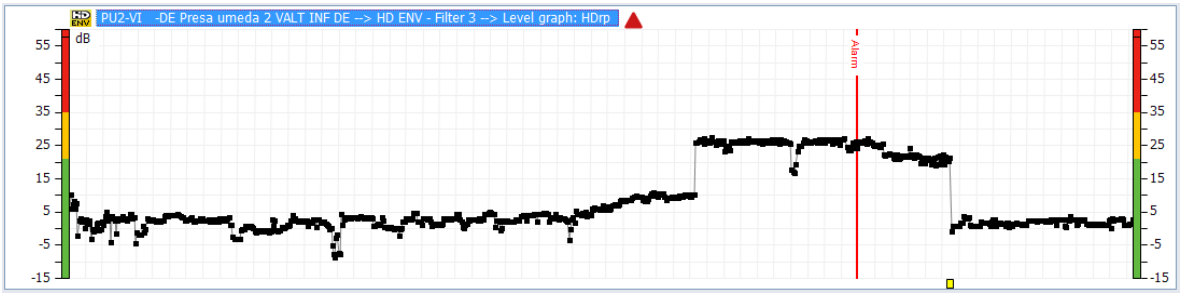


Figure 10. *HD ENV - Filter 4 trend graph, from August 2016 to November 2017.*

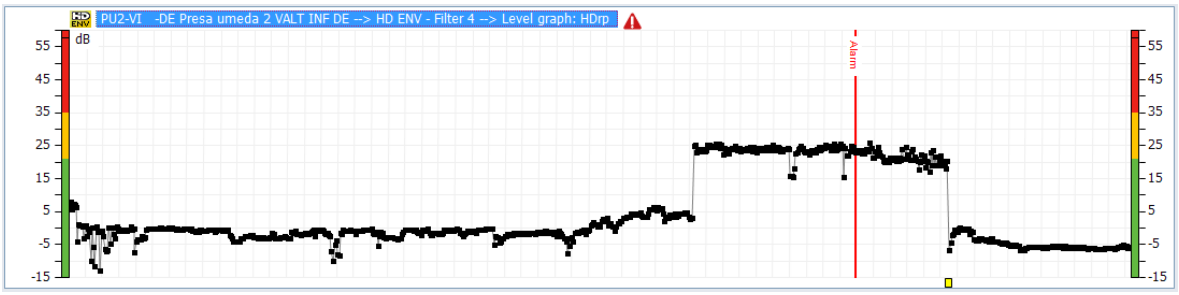


Figure 11. *HD ENV - Filter 3 spectrum before inner race crack - Press №2, Lower roll bearing DS – BPFI symptom.*

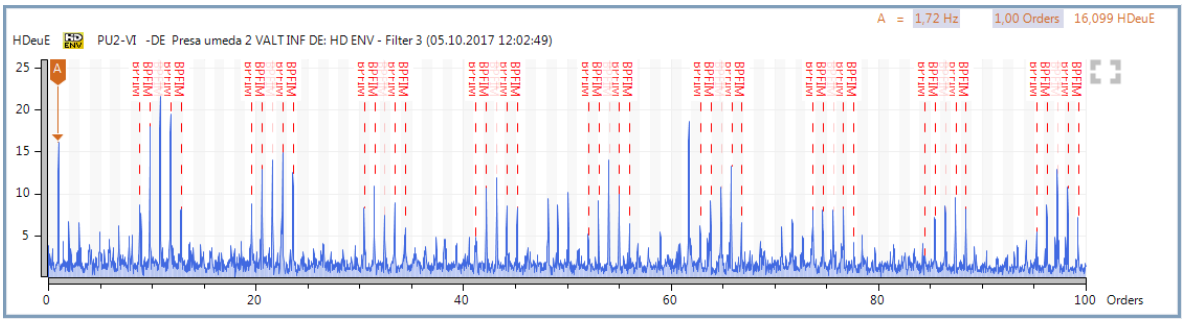


Figure 12. *HD ENV - Filter 4 spectrum before inner race crack - Press №2, Lower roll bearing DS with BPFIM symptom.*

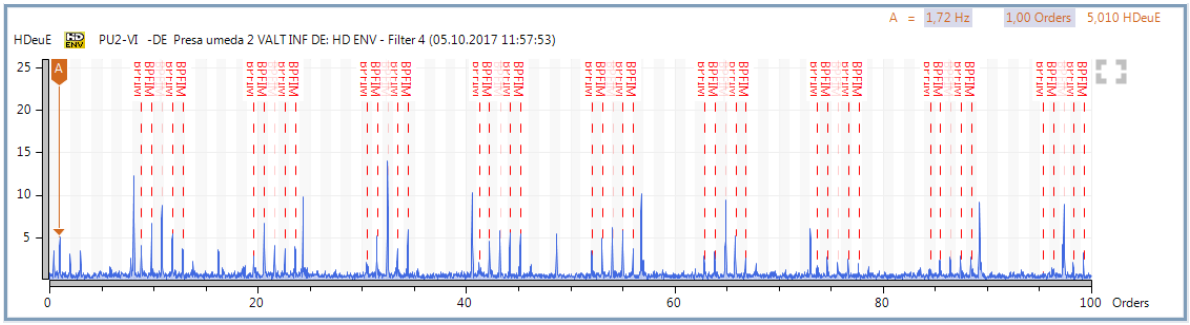


Figure 13. *HD ENV - Filter 3 spectrum after inner race crack - Press №2, Lower roll bearing DS, BPFIM symptom.*

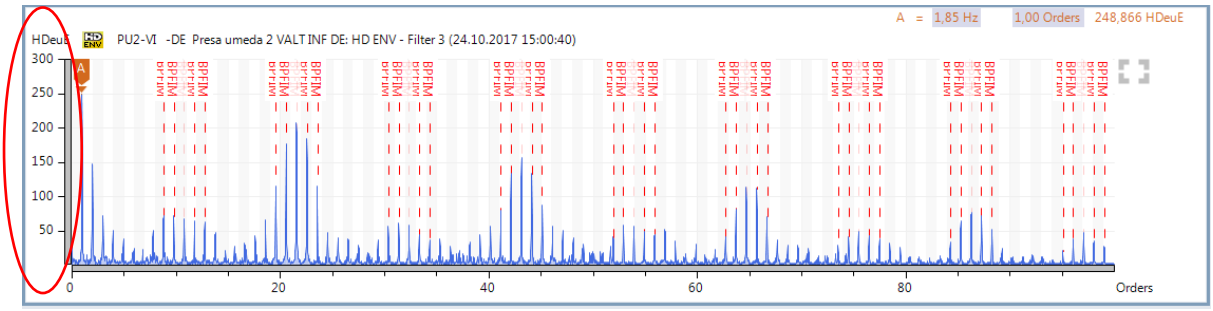


Figure 14. *HD ENV - Filter 4 spectrum after inner race crack - Press №2, Lower roll bearing DS with BPFIM symptom.*

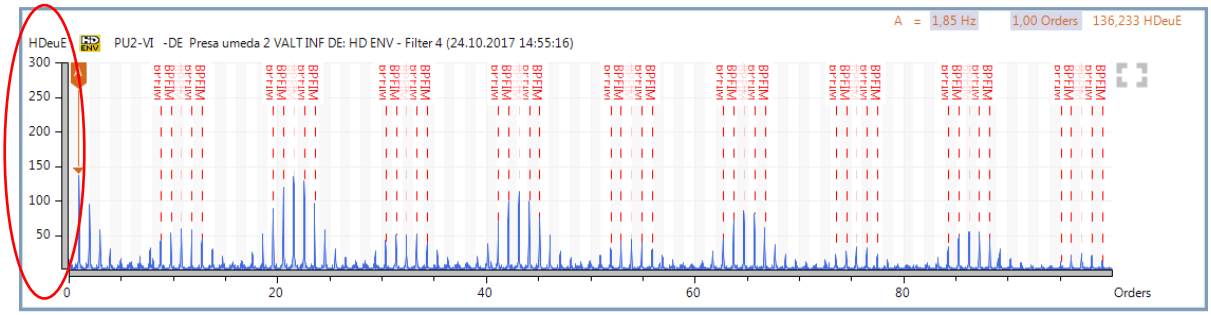


Figure 15. *HD ENV - Filter 3 Time signal and circular plot before inner race crack.*

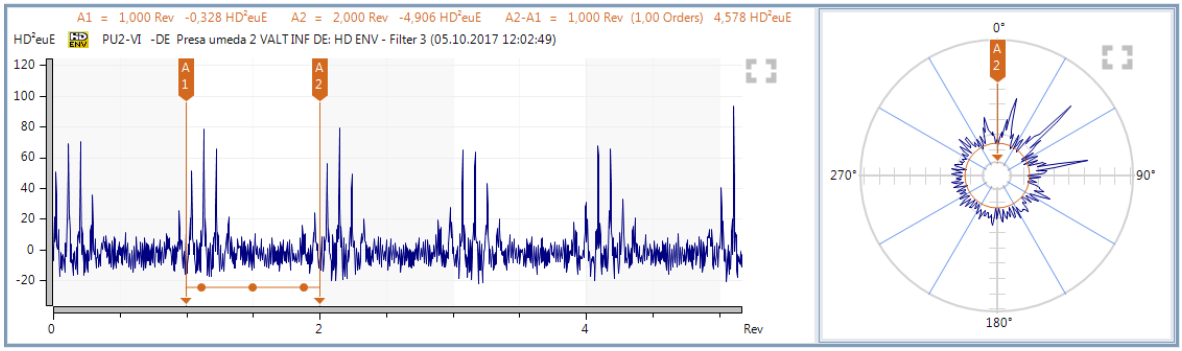


Figure 16. *HD ENV - Filter 4 Time signal and circular plot before inner race crack.*

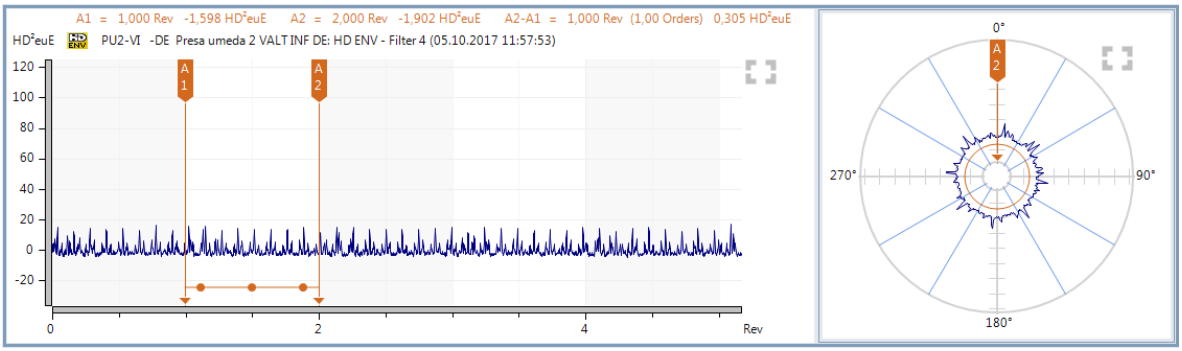


Figure 17. *HD ENV - Filter 3 Time signal and circular plot after inner race crack.*

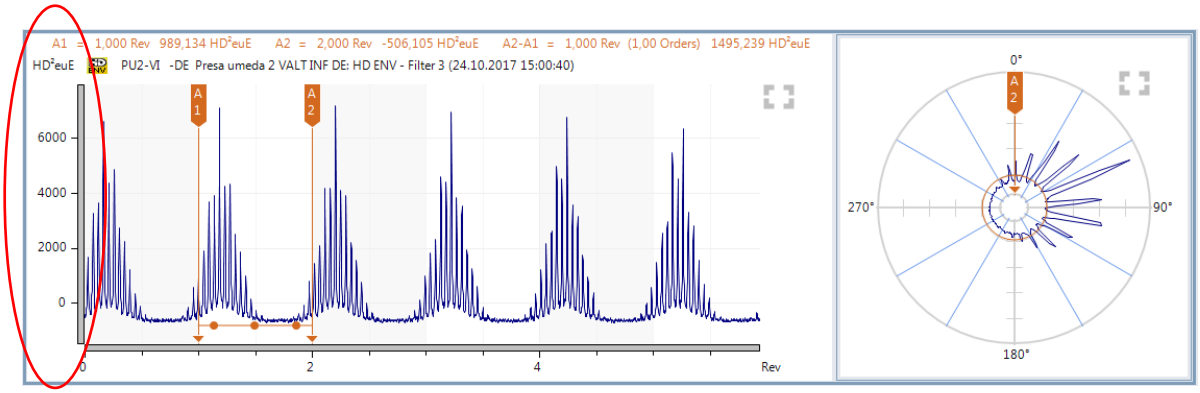


Figure 18. *HD ENV - Filter 4 Time signal and circular plot after inner race crack.*

5.3 Colored Spectrum Overview comparison, SPM HD and HD ENV

Figure 19. *SPM HD Colored Spectrum Overview from August 2016 to November 2017.*

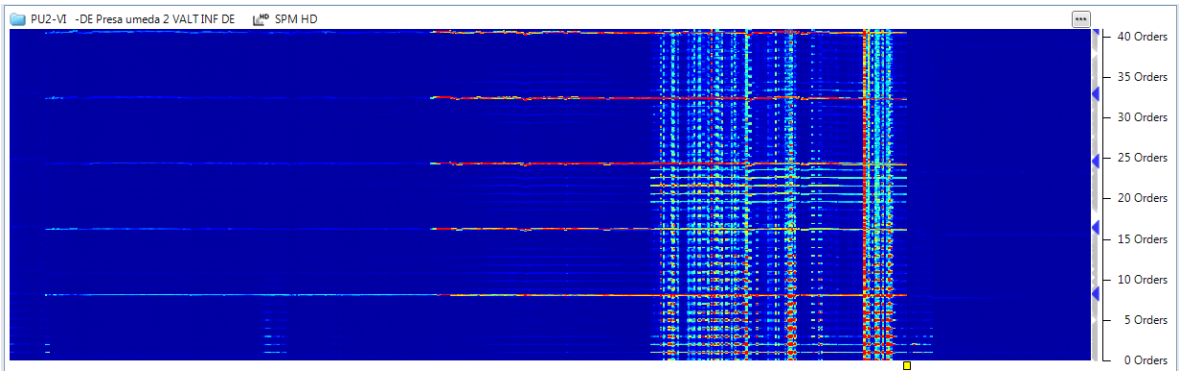


Figure 20. *HD ENV - Filter 3 Colored Spectrum Overview from August 2016 to November 2017.*

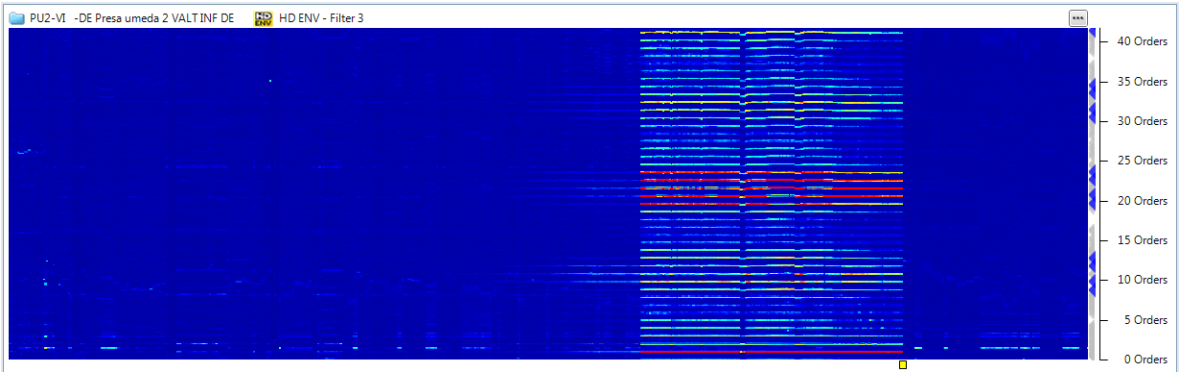
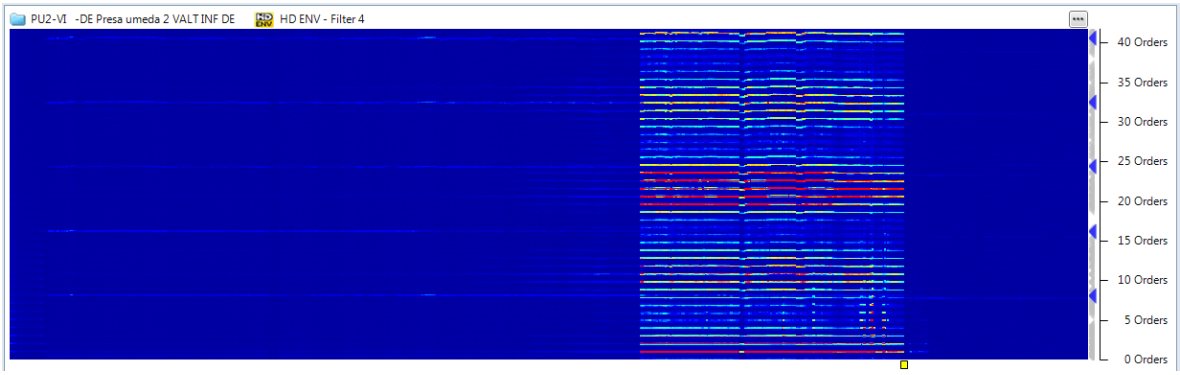
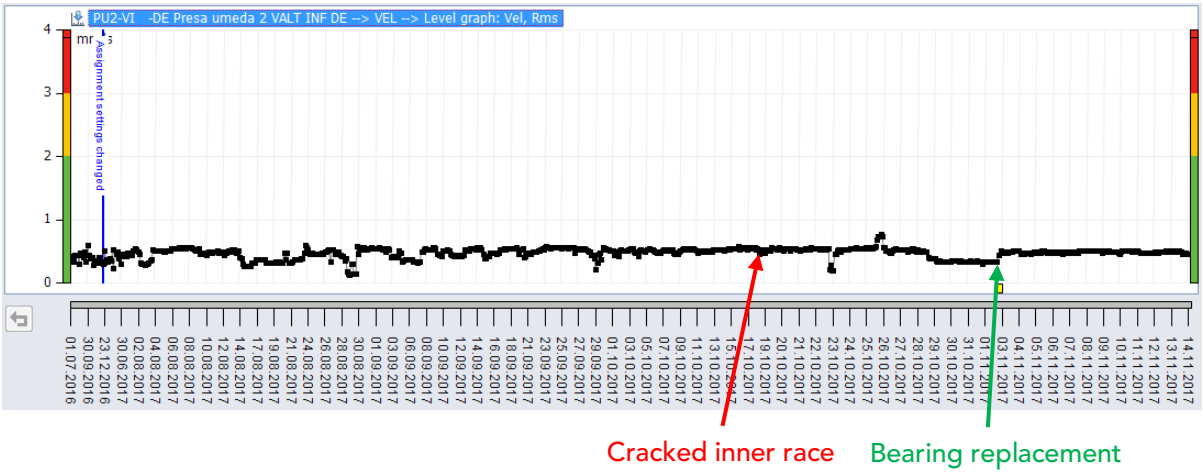


Figure 21. *HD ENV - Filter 4 Colored Spectrum Overview from August 2016 to November 2017.*



5.4 Vibration velocity measurement results

Figure 22. *Velocity - VEL trend graph, from August 2016 to November 2017.*



1 Appendix

Below are pictures of the bearing after replacement.

***Image 2**. Cracked inner race.*

***Image 3**. Cracked inner race.*

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Image 4. *Cracked inner race.*

Image 5. *Cracked inner race.*

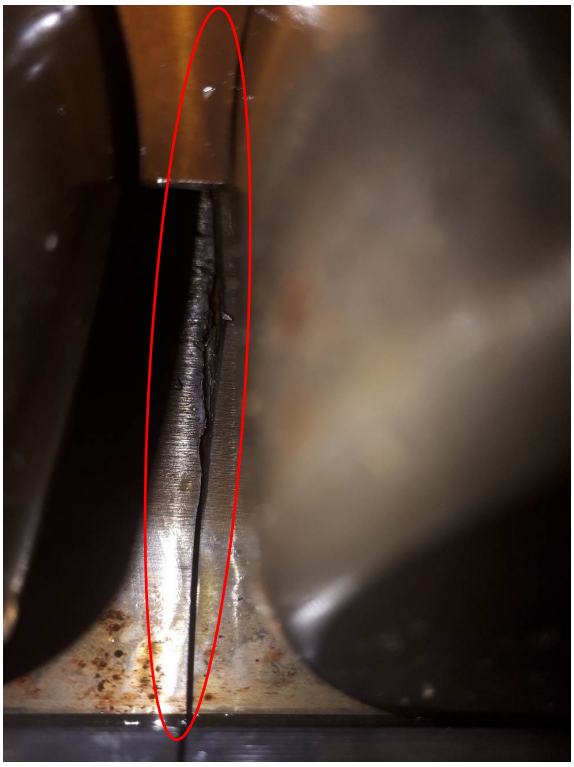

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***Image 6**. Outer race.*

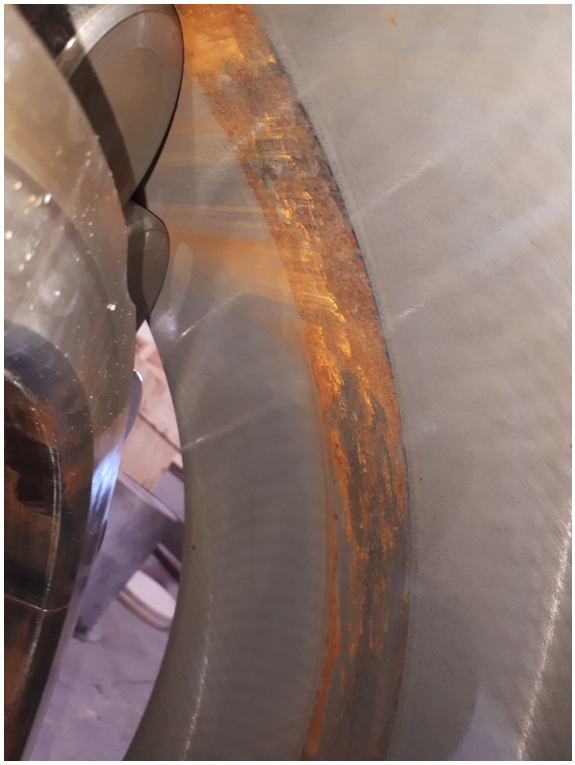

***Image 7**. Outer race.*

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