Location : PM1 Wire Section

Position : Top Wire Forming Roll

Problem : Outer race and roller defect in back side bearing

Symptoms : During shutdown on 24 September 2003 the forming roll was replaced due to planned maintenance scheduling. Baseline vibration levels recorded from the back side bearing of the new forming roll was increase above the previous average levels and were clearly not acceptable. During that time there was no specific bearing frequency generated. After few days outer race defect frequency (BPFO) start to appeared and have harmonics as well as sidebands around. Since Nov 5, 2003 the BPFO peak just disappeared and new peak which is damage cage frequency appeared. Using BVM Detailed Analysis tool from Sensodec Advisor which was setup to 10,000 Hz meas. frequency, 1000 Hz low pass with 131072 points, the envelope spectrum then shows the frequencies that caused vibration in the selected resonance range (outer race defect frequency clearly seen to this spectrum).

Corrective Action : It had been decided to remove the roll from machine during annual shutdown on February 10, 2004. Examination of the backside bearing highlighted some areas of damage on the outer race of the bearing and subsequent damage of several rollers.

Due to accurate analysis and prompt action, a catastrophic failure to the Wire Section components was prevented. If left uncorrected, would have resulted in the paper machine shutting down for a minimum of 12 hours.

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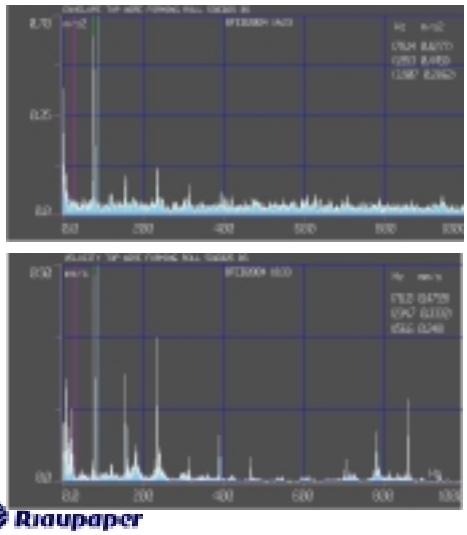
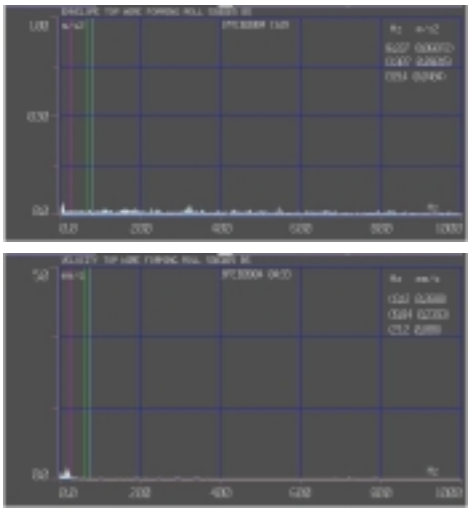
ENVELOPE AND VELOCITY SPECTRUM BEFORE BEARING REPLACED



ENVELOPE AND VELOCITY SPECTRUM AFTER BEARING REPLACED



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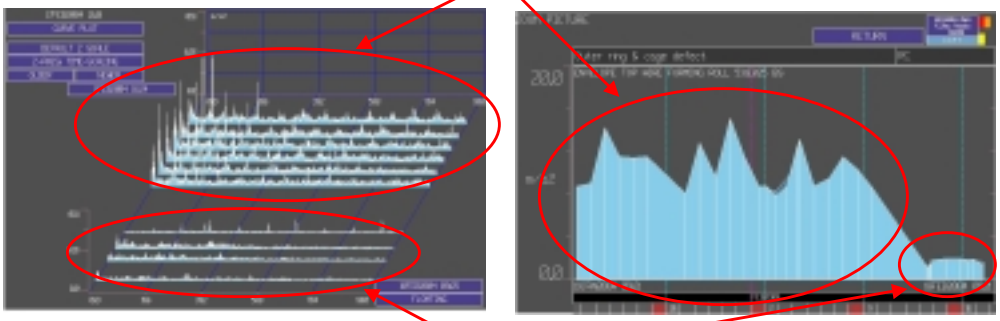
APRIL

VIBRATION SPECTRUM AND TREND BEFORE BEARING REPLACED



VIBRATION SPECTRUM AND TREND AFTER BEARING REPLACED

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Examination of the original bearing highlighted some areas of damage on the outer race and roller bearing. The photographs are clear evidence of this damage. Further examination also found that the outer race had rotated on the bearing housing.

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Cost for planned repair (US$)

Following value were used in the calculations:
- labour US$ 5 / h
- production losses US$ 10,000 / h

The time for repair was evaluated to be 8 hours for 5 man in case of planned repair.

New bearing cost was not calculated as it was taken from ex project stock.

Labour: 5 persons * 8 h * US$ 5	**US$ 200**
Material: New Bearing (Taken from ex project stock)	**US$ 0**
Maintenance Total	**US$ 200**
Production Losses	**US$ 0**
TOTAL	**US$ 200**

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Evaluated costs for unplanned repair (US$)

In case of unplanned repair the time was evaluated to be 10 hours for 5 man to change the roll and 2 hours to change the top forming fabric because the roll could not be changed without cutting the felt.

Labour: 5 persons * 12 h * US$ 5	**US$ 300**
Material: New Bearing New top forming fabric (S/C 112839)	 **US$ 0** **US$ 58,792**
Maintenance Total	**US$ 59,092**
Production Losses **12 h * 50 tons/h = 600 * US$ 200**	**US$ 120,000**
TOTAL	**US$ 179,092**

Cost Efficiency:

US$ 179,092 – US$ 200

= US$ 178,892

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