

1. Introduction

The multi-function online monitoring system
“Condition-

mation of coherence of vibration propagation) is possible.

- (6) Auto-setting of relative judgment reference values based on data of normal state is possible.
- (7) Auto precision diagnosis and analysis: Automatic precision judgment and analysis are possible when an alarm is generated by abnormality cause judgment logic.
- (8) Statistical calculation/setting of optimum prediction equation, including autoregressive integrated moving average (ARIMA) model using accumulated data, and prediction of the date on which the limit will be reached is possible.

Examples of application of the optimum diagnostic technique by equipment are shown in **Table 1**.

4. Diagnosis Examples

As results of application to press machines, reciprocating pumps, etc. using the above-mentioned technologies, detection of the following deterioration abnormalities has now become possible.

4.1 Detection of Ball Screw Bending Damage in Press Machine Transfer Unit

Abnormal peak vibration was detected in the vibration waveform measured in a ball screw bearing of the transfer unit shown in **Fig. 2**. Because this occurred during ball screw operation, the existence of an abnormality in the ball screw was diagnosed and a dismantled inspection was performed. As a result, it was found that the ball screw had suffered bending damage, causing

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data were checked again after exchanging the ball screw, the velocity and acceleration values after exchange were

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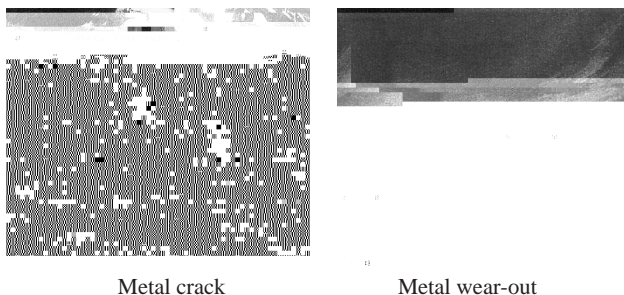


Photo 2 Wear-out and crack of bearing

impact vibration is slight, and the acceleration values have decreased to $1/5$ and $1/3$, respectively. As results of the dismantled inspection, uneven wear and crack had occurred in the metal (**Photo 2**), and damage/wear-out and backlash of the outer ring and inner ring track surfaces had occurred in the clutch bearing.

5. Conclusion

The multi-function online monitoring system “Condition-Eye” enables online condition monitoring of all types of mechanical equipment, including condition monitoring of low-speed rotation machines and rotation machines with sliding bearings, which had been difficult to diagnose with conventional technology, and equipment with instantaneous, intermittent, or 1-cycle operation. This system can make an important contribution to stable equipment operation by comprehensively supporting equipment diagnosis technologies.

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