meas
Measurement System Experts

"By making sure that the maintenance processes focus on the actual condition of the roller bearing we can ensure maximum process reliability and provide a significant amount of cost savings."

Dr Bruno van den Heuvel,
Head of the Diagnostics / Services Department at RWE Power AG

Project Profile

Customer:	RWE Power AG
Sector:	Energy industry / power stations
Task:	Continuous condition monitoring of air preheater large-diameter roller bearings
Bearing type:	Axial spherical roller bearings, diameter 1,500 mm, weight approx. 2,700 kg
Solution:	Automatic testing and monitoring system based on low-noise measurement technology and special mathematical algorithms
Signal processing:	ICP acceleration sensor, low-noise signal amplifier, digital filter
Hardware:	NI Single-Board RIO
Software:	LabVIEW

Maintenance with Foresight

RWE Power AG – Automatic Status Monitoring for Large-diameter Bearings in Air Preheaters

Detect Wear and Plan Maintenance at an Early Stage

The Starting Situation

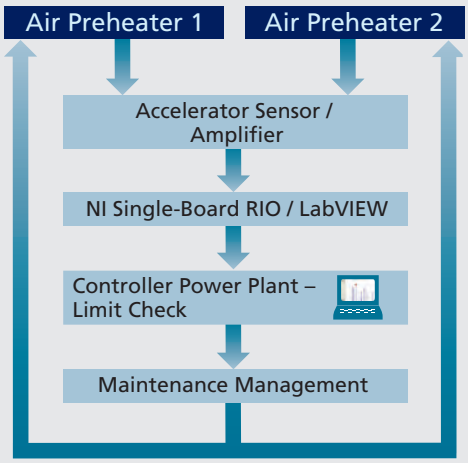
RWE Power AG is one of the leading energy production and generation companies in Germany where it operates over a dozen power stations. Of these, 9 are coal-fired stations in which the combustion air for

Bearing replacement must be well-planned.

the steam generators is preheated via rotary heat exchangers, also called air preheaters. Their supporting bearings rotate very slowly and are exposed to extremely high loads. Even seemingly insignificant defects can develop into major damage with devastating consequences if they remain undetected over an extended period of time. An unexpected bearing break can result in the shutdown of the power station for several days and result in enormous costs.

The Task

Ensuring the smooth operation of the air preheating system and preventing unplanned failures is an enormous challenge. Waiting for damage to occur and then providing purely corrective maintenance is because of the incalculable risk no solution for the preheaters large-diameter bearings. Purely preventive maintenance is also not the answer, as just shortening the inspection intervals would not provide absolute certainty and would also be inefficient. The ideal solution is predictive maintenance that is based on the actual condition of the supporting bearings. The implementation of this maintenance strategy for RWE Power required a reliable and continuously operating test system.



Our Solution

measX developed an automatic monitoring system that reliably registers even minor damage to large-diameter bearings. However, the applicable procedure, frequency analysis, was not easy to implement due to the ambient conditions, in some cases with stochastic oscillation components: the extremely short-wave, cyclical impact pulses that arise when the incipient roller bearing damage is rolled over were only very weak, while there were a multitude of disrupting mechanical signals and electronic noise that had much more energy. A mathematical method was used to significantly improve the poor signal-noise ratio and to distinguish stochastic and cyclical signal components.

Intelligent Hardware and Extensive Mathematics

The solution is based on a combination of extremely low-noise electronic components and special mathematical algorithms. The roller bearings are initially filtered and demodulated by a high-precision, low-noise amplifier using signals recorded by a sensitive acceleration sensor. Further digital processing takes place in LabVIEW on an intelligent data recording system

Reliable status monitoring:

- *x* Registration of even very minor damage
- *x* Online reporting to the control center
- *x* No operational interruption during measurement
- *x* Robust, low-maintenance hardware without a PC

(NI Single-Board RIO). From here, the processed values are automatically forwarded via Ethernet to an analysis center where the limit values are monitored.

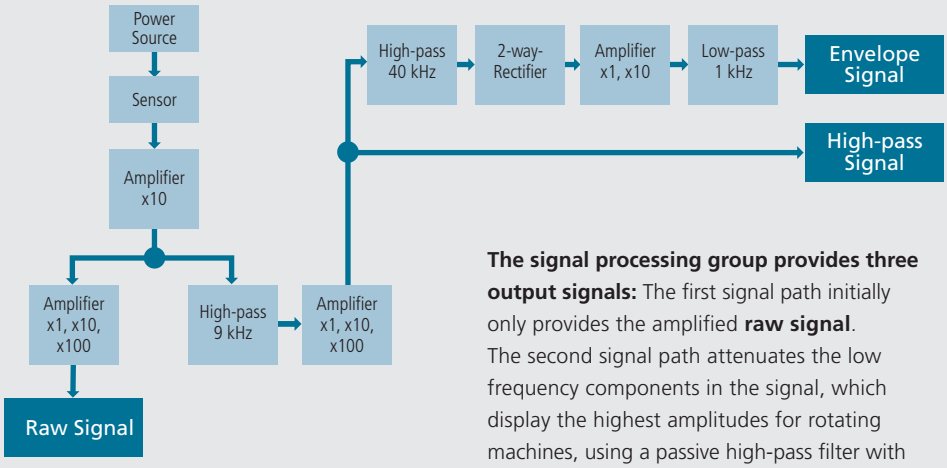
Efficient Development Process

The analytical procedure was developed using DASYLab, which provides a variety of signal analysis methods and processes as standard, that allowed the various approaches to be executed without extensive programming. A prototype using a PC with DASYLab was in operation in the Niederaußem power station, a large power station operated by RWE Power AG, for six months. The final system was ultimately implemented in LabVIEW on the NI Single-Board RIO.

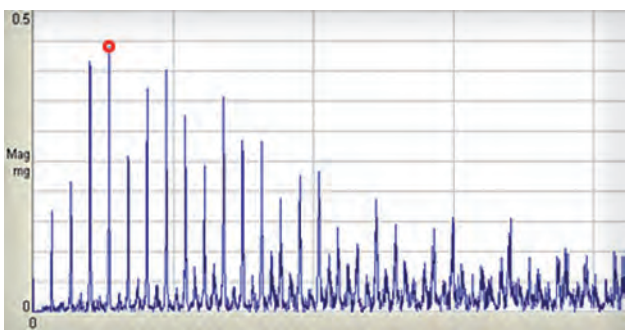
The test system was implemented as a complete system in a wall-mounted enclosure – with integrated ICP amplifier and NI Single-Board RIO.

In Practical Use

In future, the automatic test system will continuously monitor the condition of the highly stressed, slow-running roller bearings in the air preheaters in various RWE Power power stations and form the basis for efficient maintenance processes.
The recorded signals are analyzed for several minutes in a defined rhythm and the values are automatically forwarded to an analysis center via Ethernet. This ensures the reliable detection of even minor occurrences of wear. The limit values are set so that there is sufficient time to allow for the efficient planning and implementation of the maintenance. The robust test system is autonomous and does not require any external intervention, but can easily be reconfigured by import of a configuration file.



The signal processing group provides three output signals: The first signal path initially only provides the amplified **raw signal**.
The second signal path attenuates the low frequency components in the signal, which display the highest amplitudes for rotating machines, using a passive high-pass filter with a limit frequency of 9 kHz. This signal is provided as a **high-pass filter signal**.
The third signal path provides an **envelope signal**, which is generated by a 40 kHz high-pass filter (Butterworth), an additional amplifier stage, a phase rectifier and a low-pass filter with a 1 kHz limit frequency.



The software identifies distinctive characteristic values from the data flow.

measX
Measurement System Experts

For over 30 years, renowned customers from a broad range of industries have relied on us as measurement system experts. With over 40 highly qualified employees, we create custom-tailored solutions for all measurement and testing tasks.

Would you like to learn more?

Just contact us.

- Test bench technology
- Automation
- In-vehicle test systems
- Test data management
- Data analysis systems
- Crash test analysis
- Consulting
- Training

measX GmbH & Co. KG

Moenchengladbach Headquarters
Trompeterallee 110
D-41189 Moenchengladbach

Tel.: +49 (0) 2166 9520-0
Fax: +49 (0) 2166 9520-20

info@measx.com
www.measx.com

Aachen Office
Pascalstrasse 26
D-52076 Aachen

South Office
Martin-Luther-Strasse 55
D-71636 Ludwigsburg

measX . PT . FS LUVO . EN . 05.15