
PAD GmbH
Predictive Acoustical Detection GmbH

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Predictive Acoustical Detection

Introduction

Expansion of the areas of technical progress is increasing exponentially every year, which entails unforeseen breakdowns, failures of expensive equipment, which leads to a decrease in productivity.



Oil production

- Destruction of bearings of electric motors for the drive of the pumping unit.
- Bearing destruction or mechanical damage to gears of gearboxes.
- A sharp decline in lubricant quality, lack of lubrication and a fall of equipment life.



Railway

- Destruction of bearing units axle boxes, traction motors, gearboxes.
- Mechanical damage of gearboxes.
- Lack of lubrication.



Wind Power

- Destruction, mechanical damage to the nodes of the generator and gearbox.
- Mechanical damage, destruction of gearbox wheels.
- Dynamic imbalance of the generator rotor.



Industrial sphere

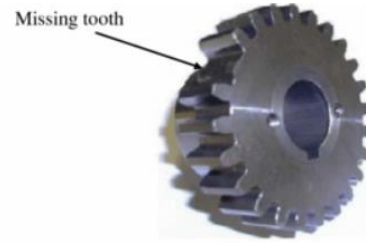
- Bearing destruction of main and ancillary equipment
- Disturbance of lubricant supply to bearing units of turbines and generators.
- Electromagnetic imbalance of generator rotors.

➤ Predictive Detection is possible for all moving parts in all equipment

Predictive Acoustical Detection

Introduction

All moving parts are subject to friction and stress



The effects of undetected defects are expensive

Due to looseness on the shaft and most likely moisture contamination these fan bearings failed, and caused the belts to catch on fire.



➤ Predictive Detection is possible for all moving parts in all equipment

Predictive Acoustical Detection

Why do we need predictive detection?

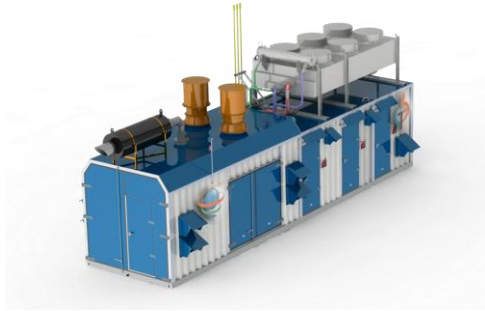
Identifying a resource of equipment at an early stage, means not just preventing a breakdown or an accident, but by taking preventive measures, significantly increase the service life of the equipment.

Today it has become a reality: the latest advances in the sphere of continuous monitoring and ultra-accurate prediction of the resource of critical components and assemblies have allowed the creation of “Predictive Equipment Complexes” of the new generation, which use the innovative application of the acoustic emission method “PULSE-WAVE” technology which doesn’t has analogues in the world.

 **Predictive Detection is possible for all moving parts in all equipment**

Predictive Acoustical Detection

Scope of application



PAD



➤ Preventing damage to all moving parts in any type of machine or vehicle

Predictive Acoustical Detection

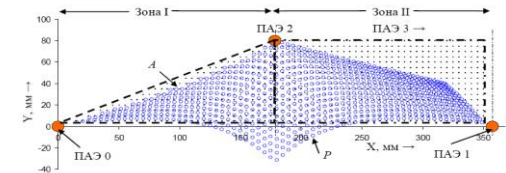
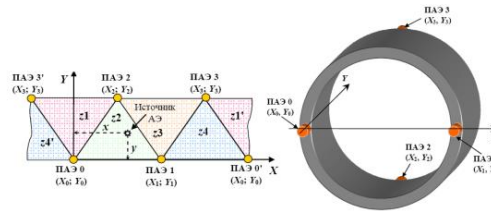
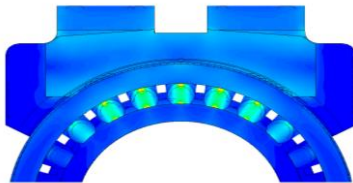
Method of PWT PAD GmbH

"Pulse Wave Technology" Innovative principle of applying the method of "acoustic emission" for the control of bearing units and gear transmission.

Structural analysis of lubricants
Compositions condition

Adaptive analysis of the motion of dislocations and metal particles

Complex structure analysis of the material



Acoustic emission - emanate of acoustic waves (single pulses of acoustic emission signals) by the control object over time.

The frequency range from 10 Hz to 300.000 Hz.

➤ **An integrated approach of predicting and detection of defects**

Predictive Acoustical Detection

Examples of PAD Pulse Wave Technology

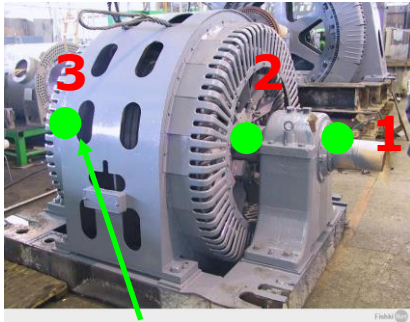
Information Reports

Date: 15.04.2016

Sub-Unit – Generator № 3

Machine Nr - 6124

Control Points - 3



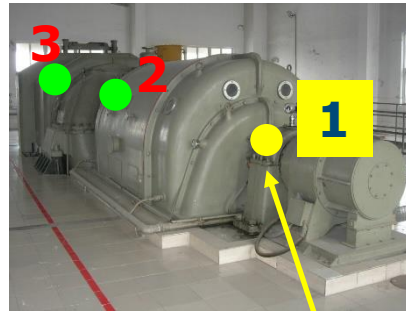
All critical areas ok

Date: 15.04.2016

Sub-Unit – Turbine № 1

Machine Nr - 6100

Control Points 3



Warning for control point 1

Inspection required by
15.05.2016

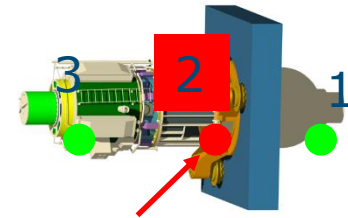
Date: 15.04.2016

Sub-Unit –

Hauptumwälzpumpe № 4

Machine Nr - 5090

Control Points 3



Alarm for control point 2

Stop operation and inspect/
Probable replacement

➤ Technology used to determine the residual life and prevention of equipment failure

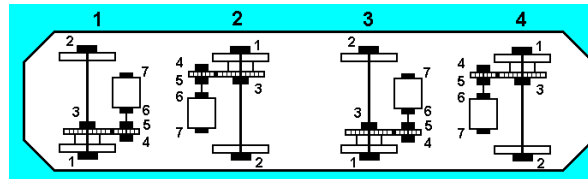
Predictive Acoustical Detection

Products

Predictive equipment complex PAD GmbH for the diagnosis of bearing assemblies with determining the resource characteristics of the defect and repair by actual condition in any application. According to its performance, the prognostic complex is divided into three types:



Single Point Portable type



Multi-point on-board type „ARP“



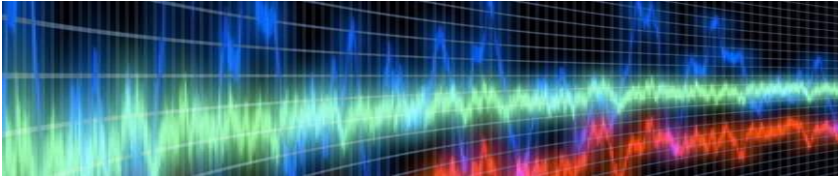
Stationary type (PAUK-11)

PAUK -11 provides automated identification of the origin and development of wheel surface defects, axle hubs, the position of wheel pairs in the frame of a rolling stock carriage during operation, automatic detection of a defective unit and type of defect.

➤ **Determination of residual life and prevention of equipment failure**

Predictive Acoustical Detection

Current solutions for detection



Vibration diagnostics

Diagnosis of machine condition and risk assessment based on vibration control.

Frequency range limited from 0.5 Hz to 20000 Hz

Analysis:

Interharmonic vibration

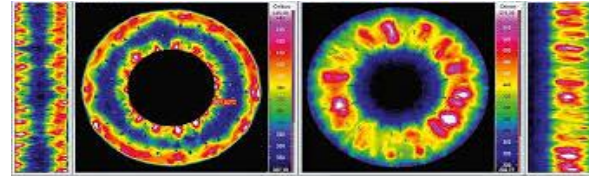
Polyharmonic vibration

Noise characteristics

Shock vibration

Difficulties in diagnosing:

Effect of resonant and spurious oscillations



Thermometry

Monitoring the state of units and parts of machines according to the parameters of the thermodynamic balance state of microscopic systems.

Temperature range from -260 to 6000 C

Analysis:

Temperatures in a controlled node

Difficulties in diagnosing:

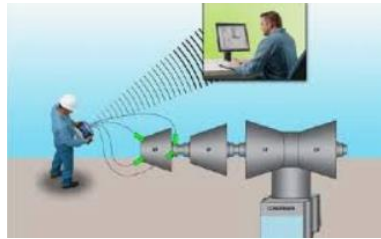
A change in the temperature rise in a controlled bearing above an acceptable level is indicated by an irreversible mechanical change in the assembly.

➤ **Each of the systems reveals a specific parameter of the defect disregarding other aspects and without the ability to make a forecast.**

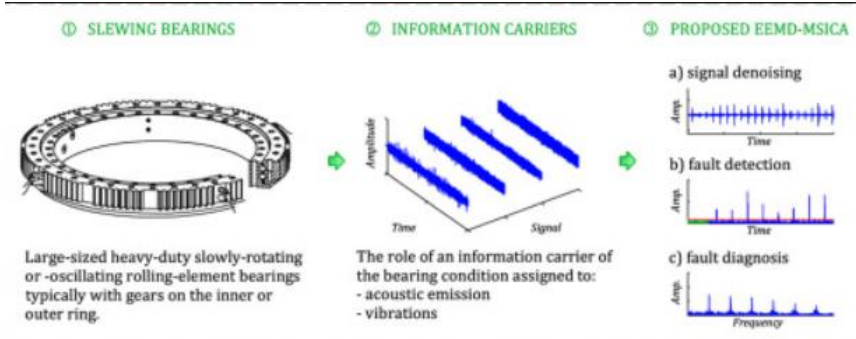
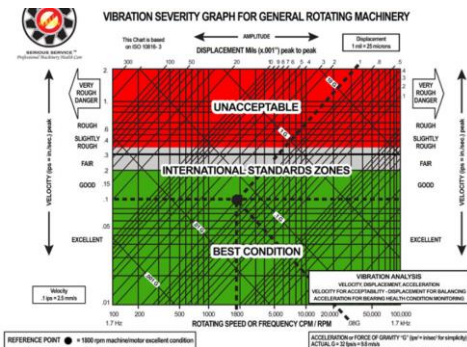
Predictive Acoustical Detection

Current solutions for detection

Current detection methods use vibration analysis



Vibrations are analyzed at controlled speeds



➤ Each of the systems reveals a specific parameter of the defect disregarding other aspects and without the ability to make a forecast.

Method of Pulse Wave Technology

The applied “pulse-wave” technology (acoustic emission method), unlike traditional diagnostics (vibration diagnostics in various versions), allows scanning the diagnosed surface of friction pairs (gears, etc.) of the equipment at the micron level, recognizing the information received, identifying the formation of defect (failure) at an early stage, when the node is still possible to save.

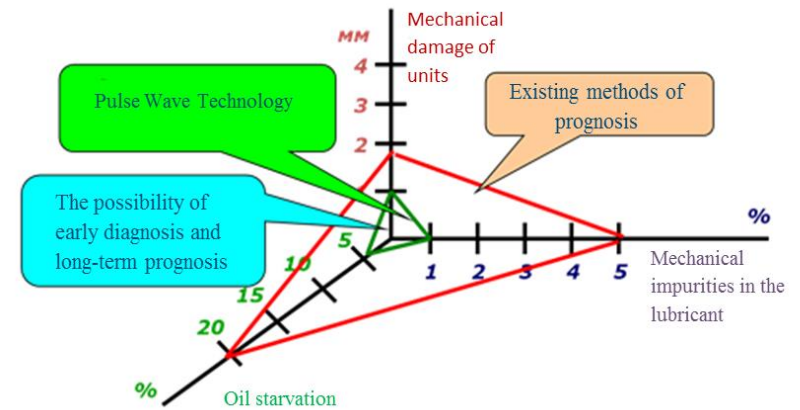
 **Identifying of defects at an early stage**

Predictive Acoustical Detection

Advantages

The use of PAD technology allows:

- To diagnose at the initial stage, absolutely all acquired types of defects in bearing units and gear transmissions, as well as to identify, describe, analyze and memorize the effects on assemblies arising from the interaction of equipment with each other and external influences;
- To conduct predictive control of technological violations:
 - - violations of the lubrication mode (changes in the lubricant layer on micron level);
 - - mechanical impurities from 0.9% in lubrication;
 - - flooding of grease from 1.5%;
 - - lack of lubrication from 5%.
- Not only to identify 100% of defects in bearing units, motors, gearboxes, but also to monitor their technical condition, with an assessment of the residual resource and the pre-failure condition;
- To create a history of operating conditions based on the received information, which will ensure a steady increase in trouble-free operation of the responsible components and assemblies leading to a significant reduction in maintenance costs.



➤ **in-depth/ broad analysis**

Predictive Acoustical Detection

Uses of PAD Pulse Wave Technology?

- To significantly increase the safety of operation of any equipment;
- To monitor bearing assemblies and gears of gearboxes, power plants, electric motors, etc., real-time constantly in operation
- automatically, in real time, generate databases, transfer results via any existing communication channels and carry out analysis to issue management recommendations;
- Analyze the actual technical condition of the controlled Equipment in the current mode with the required degree of detail;
- To qualitatively increase the planning of maintenance costs for equipment maintenance and repair.
- Make a transition to repair equipment on the actual technical condition.

 **Predict and detect**

Thank you for your
attention