

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

**Global Power  
Local Presence**

## How to Improve Early Detection of Bearing Failures

Michael Schumacher  
Technical manager  
PAMAS GmbH, Germany

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

### How to improve early detection of bearing failures

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

**Global Power  
Local Presence**

- Introduction
- Application example
- Contamination monitor
- Consequences

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Introduction



Particle counting is a well established technology in many industries including lubrication.

First systems in the 1980s

Wide introduction in laboratories in the 1990s

Wide introduction of portable systems to analyze in the field end of 1990s

Introduction of online particle counters and contamination monitors in the 2000s.

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Introduction



PAMAS is market leader in many industries

Found 1992

Located in Germany, Stuttgart area

50 employees, 7.5 Mio Euro turnover

Manufacturer of reference systems for many applications

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Application example



A paper mill in Finland is using PAMAS equipment and contamination monitors from several sources.

Lube oil from many bearing return lines is consequently analyzed over a long period of time.

The following results are from a large ball bearing.

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Application example



Date	ISO-Code
December	21/15/10
January	16/14/10
February	16/14/11
March	16/14/12
April	17/15/12
May	17/15/12

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

### Application example



Date	ISO-Code	>4µm(c)	>6µm(c)	>14µm(c)
December	21/15/10	181940	20220	620
January	18/14/10	58500	10700	740
February	18/14/11	35200	6230	1310
March	18/14/12	45470	3330	2070
April	17/15/12	118310	33120	3820
May	17/15/12	107010	25900	2690



### Application example



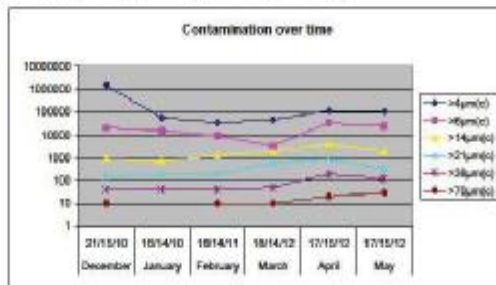
Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

Date	ISO-Code	>4µm(c)	>6µm(c)	>14µm(c)	>21µm(c)	>38µm(c)	>70µm(c)
December	21/15/10	181940	20220	620	150	40	10
January	18/14/10	58500	10700	740	180	40	0
February	18/14/11	35200	6230	1310	160	40	10
March	18/14/12	45470	3330	2070	160	50	10
April	17/15/12	118310	33120	3820	810	190	20
May	17/15/12	107010	25900	2690	320	120	20



Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Application example



This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Application example



Conclusion:

- more data from particle counter
- large and small particle sizes need to be seen independently
- ISO-code does not give critical information

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

**Global Power  
Local Presence**

## Contamination monitors

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

**Global Power  
Local Presence**

## Contamination Monitor

This is a small collection of effects we recorded with Contamination monitors.

This data are supplied from companies comparing particle counters with contamination monitors.

Other data were collected in PAMAS internal laboratory.

We will not supply further information about brands and models.

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



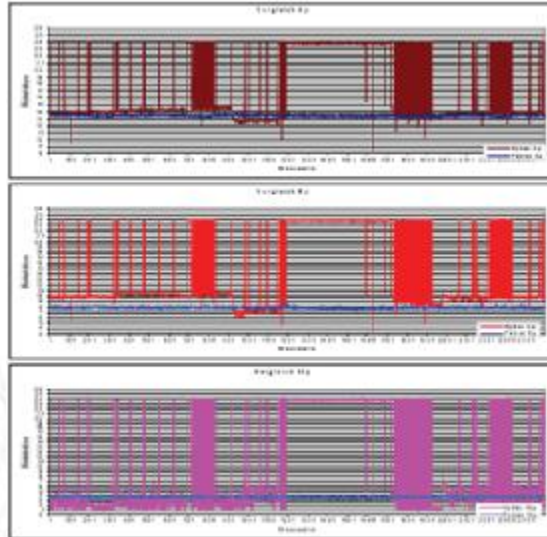
Copyright © PAMAS, 2005

Global Power  
Local Presence

## Contamination Monitor



Contamination data collected on a wind mill gear box test stand



This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

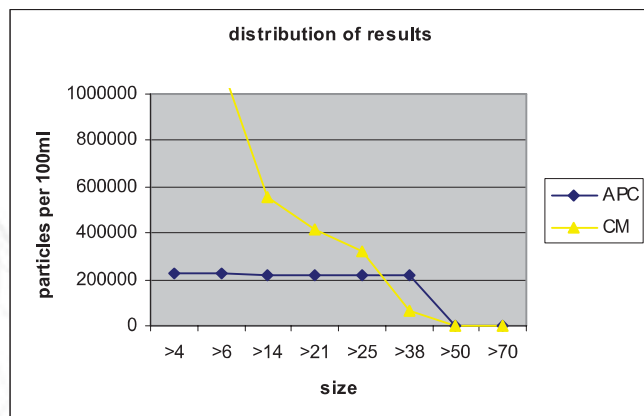
Global Power  
Local Presence

## Contamination Monitor



What happens, if large particles appear in the fluid?

We applied large (40µm) particles to clean fluid.



This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.

Particle Counting  
Technology For Almost  
Every Application.



Copyright © PAMAS, 2005

Global Power  
Local Presence

## Consequences



Large particles give valuable information of the condition of lube systems

The size distribution changes if excessive wear occurs

An ISO-Code is not enough to detect the failure

Contamination monitors cannot detect these large particles.

This page is distributed to the condition that it shall not, by way of trade or otherwise, be lent, sold, hired out, or otherwise circulated nor edited without the publisher's prior written permission.