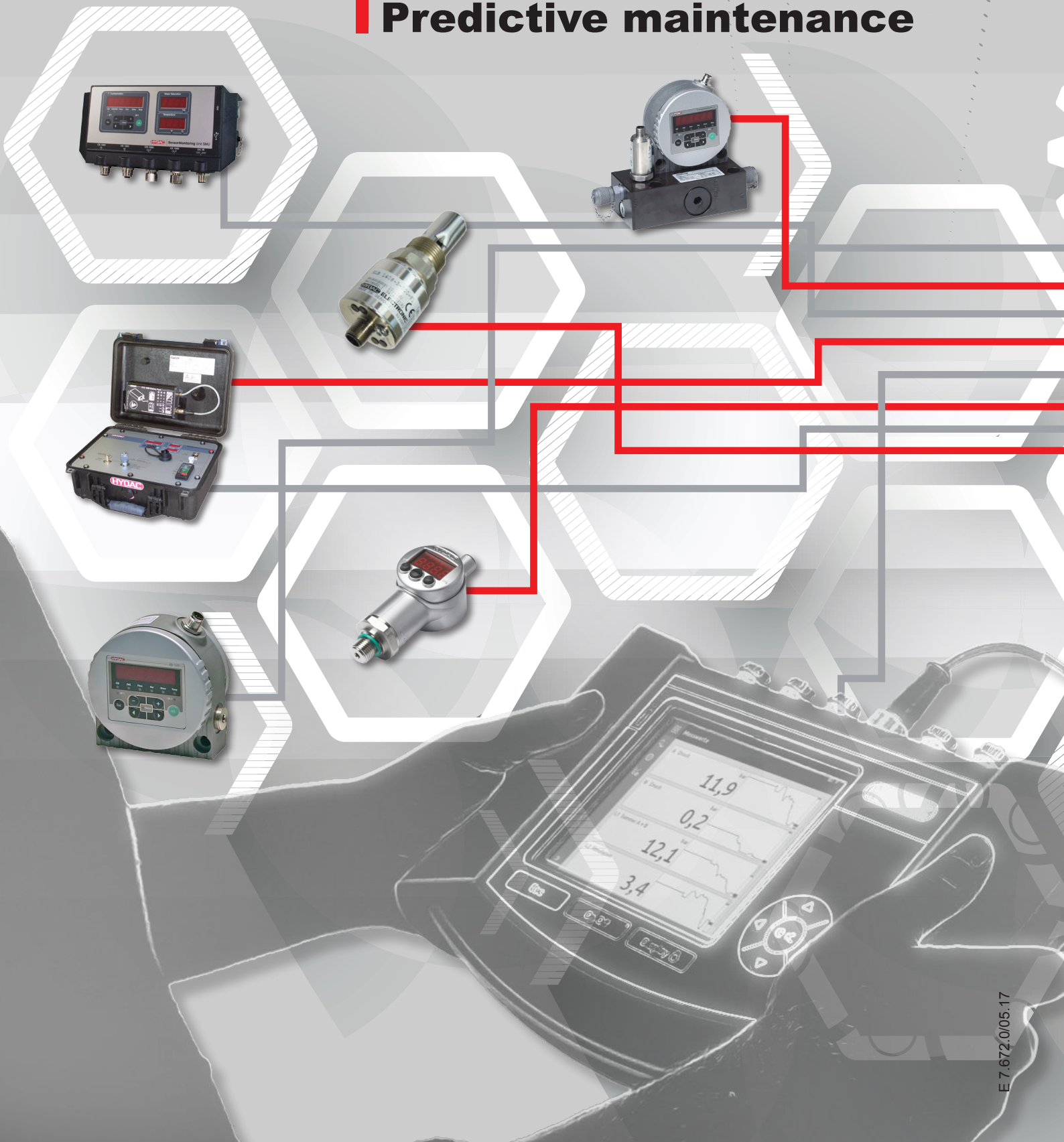
HYDAC INTERNATIONAL

HYDAC
Predictive maintenance



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Your partner for expertise in Pr

Predictive maintenance strategy – expansion stage

Operator model/worldwide field service

Online remote monitoring / HYDAC monitoring centre
Online remote monitoring / customer's central control room or monitoring ce

Online local monitoring / control room

Online on-site monitoring / at the system

Offline on-site monitoring /
at the system (inspection tours)

Level	SYSTEM	SYST
Function/ resource	Data collection	Data storage
Customised solutions		
Universal solutions		

Application packages

ConditionMonitoring Package **CMP**

Fluid Monitoring System **FMS**

Fluid sensors

Non-fluid sensors

Controls

Hand-held measuring device **HMG 4000**

HMGWin

Sensor Monitoring Unit **SMU 1200**

Condition Monitoring Unit **CMU 1000**

FluidControl Unit **FCU 1000**

Tablet PC Smartphone

- FluMoS Mobile
- FluMoS Light
- FluMoS Professional

TestCube Mobile **TCM-800**

In hydraulic and lubrication oil systems, friction, wear, leakage and excess temperatures can contribute to the operating fluid becoming contaminated, with solid particle contamination or water, for example. This contamination then goes on to cause errors in components and subsystems and ultimately in the system as a whole. Furthermore, the normal ageing process of the fluid causes performance losses that often result in system downtime.
In order to prevent these time-consuming and costly consequences, monitoring the condition of the operating fluid is of major significance. The condition of the operating fluid is comparable to a "fingerprint" of the overall condition of the system.

Implementing a predictive maintenance strategy allows the service life of all critical machine elements to be fully utilised, by detecting a variation from the fluid's normal condition early on. This is the basis for a significant reduction in operating costs resulting from costly unplanned system downtime being eliminated or minimised. As soon as the beginnings of a variation are detected, the remaining service life of the corresponding parameter or component can be estimated and used for ongoing production in a controlled manner. Meanwhile, spare parts can be procured and maintenance with minimal costs can be scheduled.

A predictive maintenance strategy thus allows available resources to be utilised optimally, reducing the total costs for the machinery throughout its service life (life cycle cost (LCC)).

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EM	PLANT CONTROL ROOM		Monitoring centre CUSTOMER or HYDAC	Worldwide service
Remote data access	Measurement data visualisation	Measurement data analysis and alarm	Application specialists	Field service crew

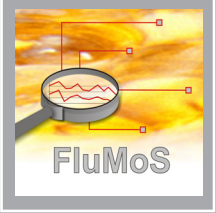
Software engineering
- CM expert

Independent from machine control
- SMU

- CMU

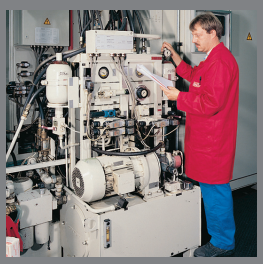
Integrated into machine control
- OPC driver

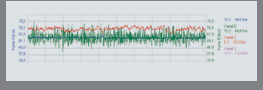
Independent from control room
- FluMoS Professional



Integrated into control room
- OPC driver

- Knowledge of manufacturing process
- Knowledge of application
- Knowledge of the components
- Interpretation of measurements taken

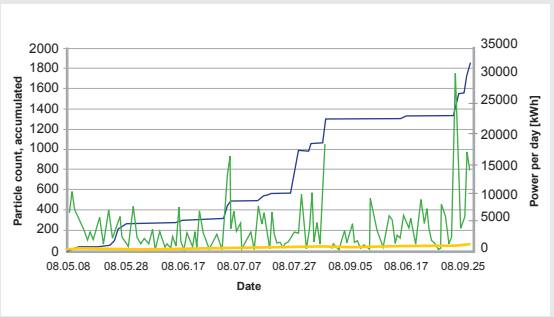




Predictive maintenance in practice

Wind energy – wind turbine gearbox

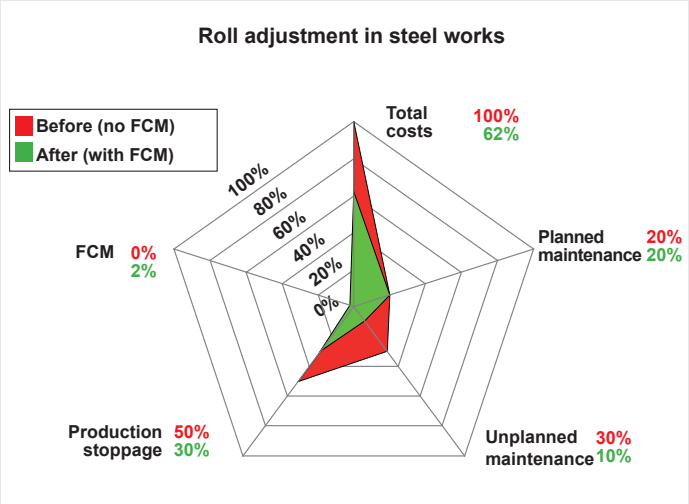
Task	To monitor the gearbox lubrication system online in order to prevent secondary damage and also production stoppages (electricity generation).
Solution	Installation of a MetallicContamination Sensor (MCS) for full-flow monitoring of the lubrication circuit.
Result	● As the image shows, a MetallicContamination Sensor (MCS) was used to detect a bearing failure. ● The curve shows the number of accumulated particles, i.e. the amount of metal detached from the driving gear. Each jump corresponds to one or more detected metal particles. ● The first warning was confirmed by a visual inspection because the main bearing showed slight damage but this was classed as non-critical. Consistent with this, a repair was planned and until then the wind turbine could continue to be operated at 80% capacity (the lower curve in the graph shows the power generated). ● The progress of the damage was monitored until the bearing repair was performed. ● No unplanned maintenance or downtime was required and the costs for a new gearbox (roughly €360,000) could be avoided.



Steel industry – rolling mills

In rolling mills the operating fluid for controlling the rolls is exposed to very high rates of solid-particle and water ingress. This is inherent to the conditions of hot/cold rolling processes.

Task	To reduce unplanned maintenance and downtime costs by installing fluid sensors.
Solution	Standardisation of a Fluid Condition Monitoring subsystem and its integration in the hydraulic circuit. The subsystem consists of a visual particle sensor, a water sensor and a data-logging device with display.
Result	The maintenance and downtime costs could be significantly reduced.



Predictive maintenance in practice

Aviation – hydraulic aircraft pumps

In aviation the guaranteed service life for hydraulic pumps is normally 10 years. This leads to intensive quality tests and as a result, higher warranty costs over the whole life cycle of the pumps.

Task	To reduce both the costs of inspection (previously carried out manually, with individual oil sampling and analysis) and the warranty costs.
Solution	The number of wear particles produced during the function test is a measure of the service life of every pump. Therefore online particle sensors were tried out on the test rigs and introduced as online quality testing.
Result	Inspection and warranty costs reduced by >10%.

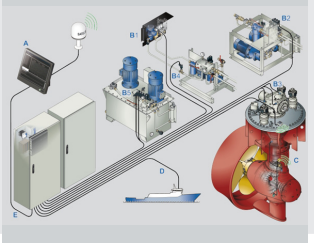
Mobile industry – mining vehicle fleets

In the mining industry availability and efficiency are paramount.

Task	Reduce unscheduled maintenance, extend the service life of critical components and oils, increase availability and efficiency.
Solution	Use of portable particle counters and offline filtration, both periodically and when limit values are exceeded. Depending on the local circumstances, sample bottles, portable particle counters and online sensors are used to detect excessively high contamination levels.
Result	Unplanned maintenance work was reduced, availability and component service life was increased (availability +10%, reliability +35%, unplanned repairs -35%)

Marine/offshore industry

Task	Monitoring of the required oil cleanliness for wear prevention and water ingress into the lubricating oil of thruster drives via seals
Solution	Installation of online fluid sensors in the form of a ready-for-connection, application-specific all-in-one solution
Result	● Required thruster availability secured ● Dry dock waiting times reduced by >60%

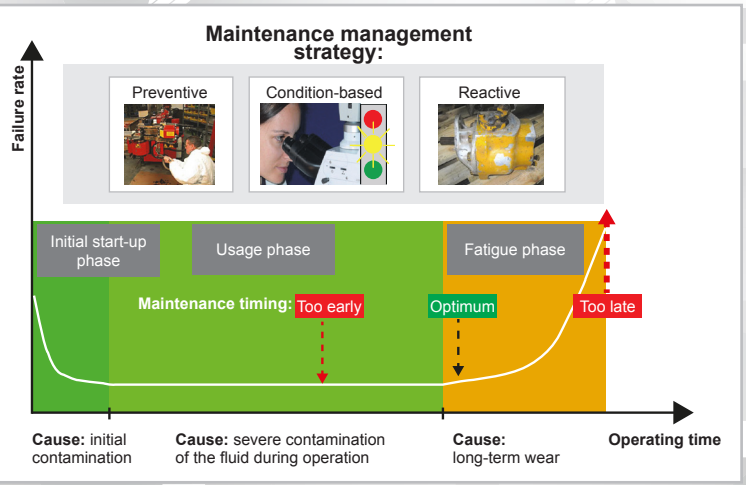


The advantages of predictive maintenance

- Continuous monitoring of the machinery via the condition of the fluid and the fluid conditioning components
- Demand-based planning of maintenance intervals
- Early detection of defects and imminent damage
- Avoidance of unplanned machine and system downtime
- Increased availability, safety and productivity of systems
- Increases efficiency, because components no longer have to be over-sized
- Cost savings in the course of life cycle management

Maintenance strategies compared

- In the reactive model, the biggest cost factors are unplanned maintenance and production stoppage.
- In the preventive model the biggest cost factor is the high proportion of planned maintenance.
  Moreover, components are rejected which could continue to be used.
- In the predictive model, there are some small additional costs initially for the Fluid Condition Monitoring System, but the total operating costs and therefore the LCC are the lowest.



Maintenance concept

Costs	Reactive	Preventive	Predictive
Planned maintenance	20%	50%	20%
Unplanned maintenance	50%	5%	3%
Production failure	30%	10%	3%
Fluid Condition Monitoring investment	0%	0%	10%
Total costs	100%	65%	36%

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