



Brüel & Kjær Vibro



We deliver lead-time to maintenance!

**Remote Condition Monitoring
Program for Wind Turbines**

Value

A pro-active wind turbine condition monitoring strategy offers clear advantages to your operation & maintenance program. It allows you to make service interventions in order to avert catastrophic failure, perform inspections that are prioritized and properly focused, and optimize maintenance scheduling and costs. When properly implemented, condition monitoring systems and services can significantly increase uptime, improve reliability and even extend the lifetime of the wind turbines.

Can any condition monitoring system be used for wind turbines?

No! The monitoring requirements for a wind turbine are very special in relation to other machines and

therefore require a dedicated monitoring system concept. The widely variable operating conditions coupled with non-rigid foundations, complex gearbox and low rotating speed require an entirely different monitoring approach for wind turbines. Moreover, wind parks are geographically dispersed, so it is not always cost effective to use on-site diagnostic specialists. A centralized condition monitoring centre solves this problem, but it separates the diagnostic specialists from the turbine operators and service managers.

Brüel & Kjær Vibro has not only developed a dedicated monitoring system, but also adopted a unique service program, where there are clear procedures for integrating the

information and work flow between the Condition Monitoring Centre and operator service departments.

Why use Brüel & Kjær Vibro?

With over 50 years of experience in machine condition monitoring, we know the customer needs and technology well, and we have world-wide network of sales and support to back us up with. Condition monitoring is our core business, with strategic focus on wind turbines. We are completely independent of machine manufacturers and repair shops, but we have worked closely with a select few wind turbine manufacturers and end-users in order to improve the way we monitor the machines. We are in fact the preferred supplier to several large wind turbine manufacturers.



In addition to downtime, service at remote locations can be expensive.

Concept

Successful condition monitoring is not only a matter of having reliable hardware and software; it is equally important to have an efficient organisation with the capability and capacity to transform the large amount of data into actionable information. The primary elements in our remote monitoring and diagnosis program (which is Germanischer Lloyd approved) includes:

- Local data acquisition units
- Alarm management and review of all alarms by analysts in the Condition Monitoring Centre
- Reporting actionable information to customer service groups

Fault detection and diagnosis

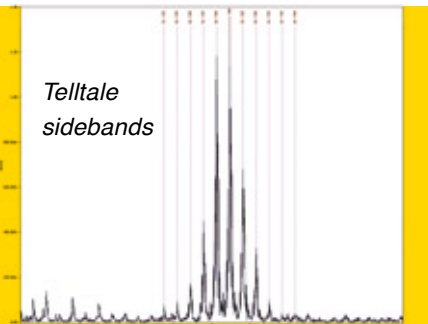
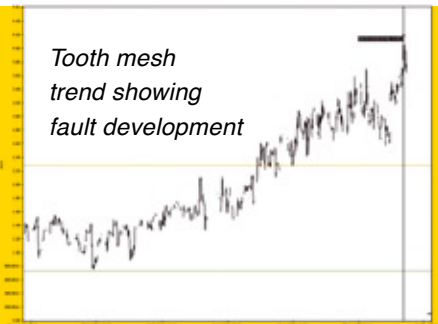
Our monitoring system has been specially designed to detect and diagnose a number of faults at an early stage of development. This includes faults found in the bearings, coupling, shaft, gearbox and support structure. The monitoring system has proven to be successful over several years with many applications world-wide.

Only relevant alarms

One of the most important functions for a wind turbine monitoring system is dealing with the flood of warnings and alarms. Wind turbines operate in widely varying conditions, such as weather and load, and consequently

the vibration response will vary accordingly. By monitoring to specific power loadings, this significantly minimizes these types of alarms. But there can be a cascade of other alarms that are also operation related, i.e. not associated to any component fault, such as transient events (gusting, yawing, etc.).

Brüel & Kjær Vibro's intelligent alarm management system filters out these irrelevant alarms, and in the case of a component fault where there can be several alarms for the same fault, these are automatically reduced to a single alarm. Every alarm is evaluated by the Condition Monitoring Centre analysts.



A chipped tooth on a wind turbine gearbox detected by our system.

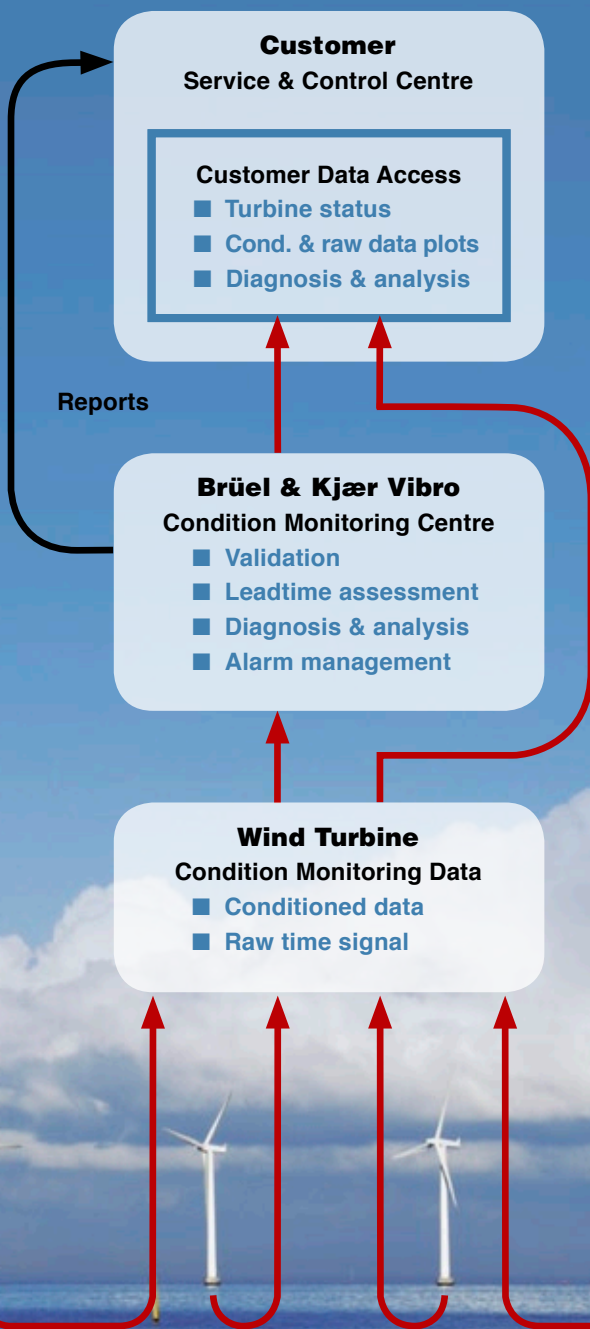
continue...

Concept ...continued

Effective alarm management and lead-time prediction

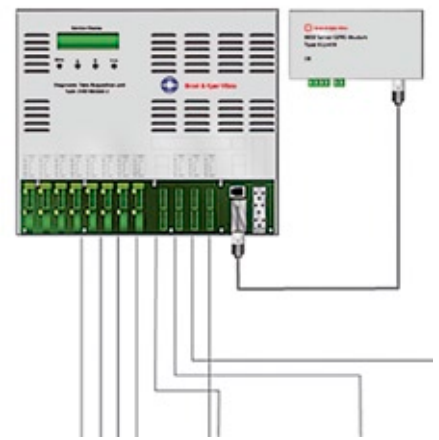
The alarm management system employs a severity assessment concept for more accurately planning service. The severity of every detected fault is related to the vibration amplitude, rate of

progression, type of fault and the type of machine component. A number of severity classes have been defined, each related to an estimated lead-time. This information is passed on to the customer together with a diagnostic evaluation of the alarm.



Program

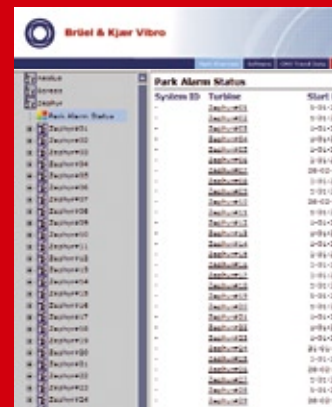
The Brüel & Kjær Vibro condition monitoring solution is an all inclusive program of deliverables that give actionable information for ensuring lead-time to maintenance of the wind turbines and optimizing uptime.



Hardware

The data acquisition units are locally installed in the wind turbine nacelle. These send conditioned vibration measurements for fault detection, and time waveforms for analysis and diagnosis.

At-a-glance status alarm of all wind turbines



Reporting

All monitoring, diagnoses, reporting and action calls are done by ISO 18436-2 cat. II and III approved analysts. Each alarm report includes detailed information on the observations, interpretation and the recommended action.



Operator data access

All recorded data and status information can be seen in a secure website through a browser. The current alarm status is displayed for the entire park and each turbine. The severity of each alarm is indicated to show the urgency of the service action. All



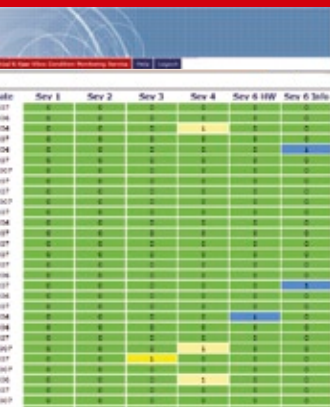
alarms displayed have been evaluated by analysts.

The WTG diagnosis program allows customers to see and analyze the data. It is based on the same software used in the Condition Monitoring Centre. Here you can download data and perform your own diagnoses.

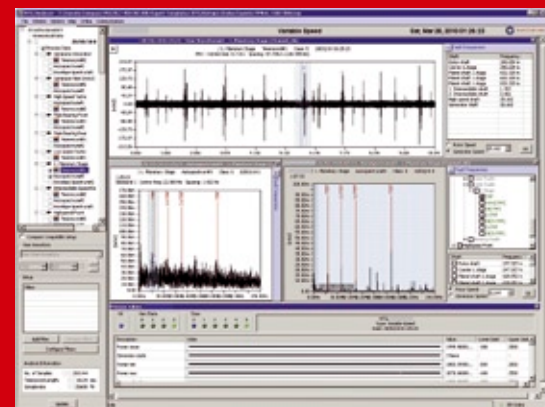
Project Management

The project implementation is well structured and defined, without hidden engineering costs. After an order has been confirmed:

1. Client gives turbine and park data to Brüel & Kjær Vibro
2. Hardware is installed in wind turbines and commissioned.
3. Alarm limits are fine-tuned
4. Monitoring and diagnosis can begin. No IT maintenance on monitoring equipment needed from customer! This is done by us.



Plot showing all monitored data



Diagnosis & analysis program for the customer



Brüel & Kjær Vibro A/S

Skodsborgvej 307 B
2850 Nærum
Denmark
Tel.: +45 77 41 25 00
Fax: +45 45 80 29 37
E-mail: info@bkvibro.com
www.bkvibro.com

Brüel & Kjær Vibro GmbH

Leydheckerstrasse 10
64293 Darmstadt
Germany
Tel.: +49 (0) 6151 428 1100
Fax: +49 6151 428 1200
E-mail: info@bkvibro.de
www.bkvibro.de