

Effective and simple condition based maintenance

MACHINE AVAILABILITY Condition based Maintenance (CbM) programs are becoming a standard maintenance strategy for the marine industry. More and more shipping companies acquire and use condition monitoring equipment on board their vessels to monitor the health of the machinery on a ship.

Simon Leberz

Condition monitoring reduces the risk of sudden machinery failure and therefore prevents unplanned and costly downtime and increases the machine availability. An important role is also played by the classification companies. The overhauling time of any ship can be drastically reduced by running a clearly structured CbM program. Useless intervention on machines that run in good conditions can be avoided and overhauling time can be optimized, unnecessary costs can be saved. But how can a CbM program properly be conducted if there is no skilled personnel onboard?

There are basically two different possibilities to monitor machine conditions: either by the use of portable data collector or by using permanently installed monitors, so-called online Condition Monitoring Systems (CMS). Which solution to choose depends mainly on the type of machine, the official regulations and, fi-

nally, the user requirements themselves. The perfect solution is mounting online CMS for critical machinery and monitoring the rest of machines with portable instrumentation.

Portable data collectors

For the standard machines on a ship such as motors, pumps and fans using portable data collectors and a proper CbM PC software is all what is needed. To run an accurate CbM program it is essential to have reproducible and high quality measurement data collected. This is not always easy to fulfil. It is very important to understand which measurement locations and what kind of measurement tasks are needed to properly collect meaningful machinery health data. An automated measurement location recognition system with customized measurement tasks is crucial. A smart solution is provided by the VIBCODE® sensor system which automatically identifies the coded measurement location and takes high quality readings on the fixed installed measurement studs which do also ensure an outstanding vibration signal transmission.

A typical workflow compiled by specialists and user is the following: Defining a list of machines to be monitored and collecting all relevant information per machine such as, but not limited to, the type of bearing, operating speed (RPM), power, foundation type, etc.

Then, for each machine, the required number and location of measurement is defined.

The CbM database is setup by the specialist and all relevant measurement tasks are configured for each measurement location. Portions of machines found onboard are grouped into so-called 'measurement routes'. These routes are then downloaded on the portable instruments.

The operator of the instrument connects the VIBCODE® automatic measurement location recognition transducer on the



Vertical pumps equipped with 4 VIBCODE® measurement locations each

CBM PROGRAM IMPLEMENTATION TASKS	List of relevant machines Define relevant machines to be included in CbM program
	Machine data information Acquire all machine data (power, rpm, type of bearings, number of teeth on gears, number of blades in fans, ...)
	Definition of RbM program Setup a CbM plan and define VIBCODE® measurement locations, required measurement types and their corresponding setup, define measurement periodicity, ...
MEASUREMENTS ON VESSEL	RbM database setup Setup OMNITREND® CbM database & define routes
	Route download Download measurement routes to Prüftechnik portable data collector
	Measurements Perform measurements as requested by the Prüftechnik data collector using the VIBCODE® automatic measurement point identification system
DATA ANALYSIS, DIAGNOSTIC AND CORRECTION ACTIONS	Route upload Upload measurement routes from Prüftechnik data collector to OMNITREND® database
	Data export to RbM specialist Measurement information is transferred automatically via IDR* from the OMNITREND® database to the onshore CbM specialist (e. g. PRÜFTECHNIK)
	Analysis of measurement data A specialist – at customer side or the "Germanischer Lloyd" certified Monitoring Center of Prüftechnik – analyzes received data and formulates a diagnostic
	Corrections and actions After formulation of actions: typically balancing, alignment and other tasks must be fulfilled on the vessel to enhance the condition of the analyzed machines (customer or PRÜFTECHNIK)

Typical workflow for the implementation and operation of a CbM program on ships

coded studs that have been previously mounted on the defined measurement points on the various machines. The VIBCODE® transducer reads the coded location and 'knows' which measurement tasks need to be taken at each coded point. Once the measurement routes have been finished they are uploaded and stored into the OMNITREND® software.

Remote measurement analysis

Measurements are taken every 4-6 weeks. A portable VIBSCANNER® data collector equipped with the VIBCODE® automatic location recognition system ensures error-free readings.

Characteristic overall values (so-called level 1 monitoring or detection phase values) are collected. Overall values include machine vibration data and roller bearing condition data (e.g. shock pulse measurements). These characteristic level 1 values are collected in graphs and trended by time.

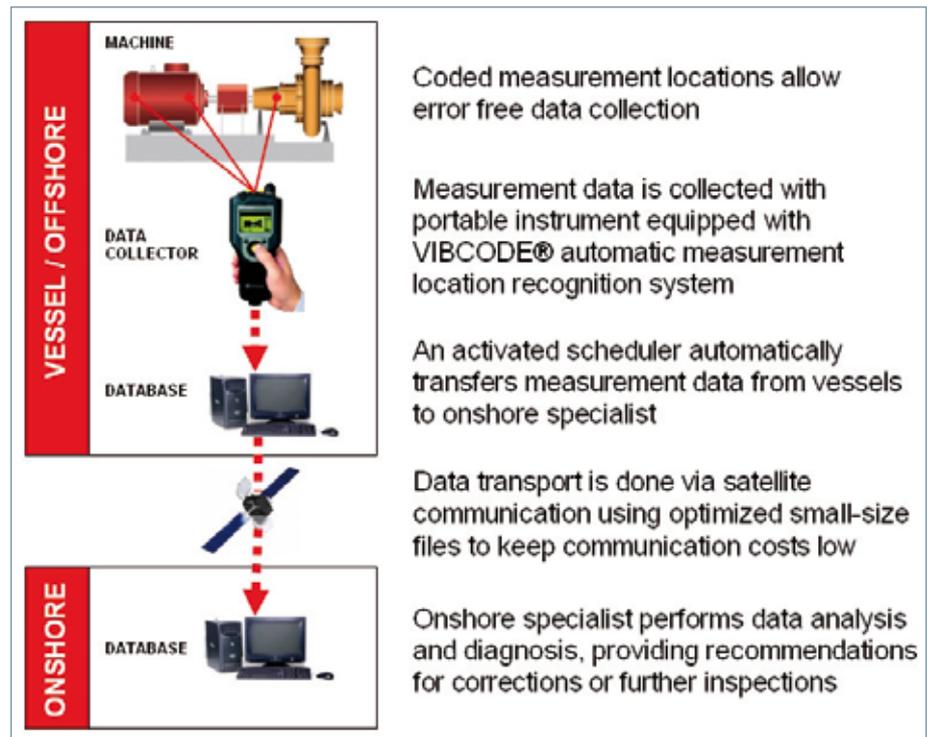
Alarm limits can easily be set by the specialist to allow users to detect deterioration of the machinery health at a glance.

This has also been experienced by the Qatar Shipping Company (QSC) the Prüftechnik Service & Diagnostic Center` prepares regular analysis reports for. According to Rahul Bhargava, Technical Manager of QSC, the remote analysis service increased the benefit of their inhouse CbM program by preventing some unplanned shutdowns.

To find the root cause of detected problems, in-depth analysis can be performed using further signal measurements such as spectra, envelope spectra and time waveforms. The signal analysis (or so-called level 2 monitoring or simply the analysis phase) ensures identification of the root cause of problems and allows eradication. Analysing the collected data requires a skilled vibration analyst, which usually demands having the possibility to send collected data to a specialist.

Intelligent Data Replication Process

The OMNITREND® software platform of Prüftechnik is not only used to configure measurement setups but is also used to store collected data. The Germany-based company developed an Intelligent Data Replication Process (IDRP) functionality



Workflow of a CbM program using the intelligent Data Reduction Process (IDRP)

that is integrated in the OMNITREND® software platform. For analysis purposes a small-sized data export file can be sent to a service provider by email. This is done automatically with the aid of a scheduler that is part of the program. No further human intervention is needed for exporting data. As the data export file will be sent in a packed file format (zip) the file size can be kept to a minimum. An example: A typical database on a ship contains about 100 to 150 measurement locations. If readings for the last three months are transferred by email, the size of the export file is not more than 600 KB using the IDRP functionality. Furthermore, only the last collected data is automatically transferred to the expert assuring that there is no unnecessary data overlap, which effectively reduces the data load. This smart software solution keeps the costly satellite communication cost very low. At the onshore service provider or specialist, files are automatically collected by the Email Center software that stores the data files from the vessel(s) in the corresponding database(s), accordingly. Thanks to the smart and simple IDRP functionality

no further complicated offline synchronization procedures are needed.

Finally, the most important task onboard the vessel is to take readings on a regular basis. This is needed to have enough data to be able to detect even small machinery health variations in the trends at an early failure evolution stage. Regular readings are a must to be able to perform reliable CbM. The regular readings must also include the required level 2 measurements for further analysis and diagnosis performed by a specialist. The Prüftechnik Service & Diagnostic Center (SDIC) is certified by Germanischer Lloyd (GL) and performs the so-called "remote analysis service" for marine customers. To ensure that no database setups are changed by the vessel's crew, access rights to the OMNITREND® software can be restricted.

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