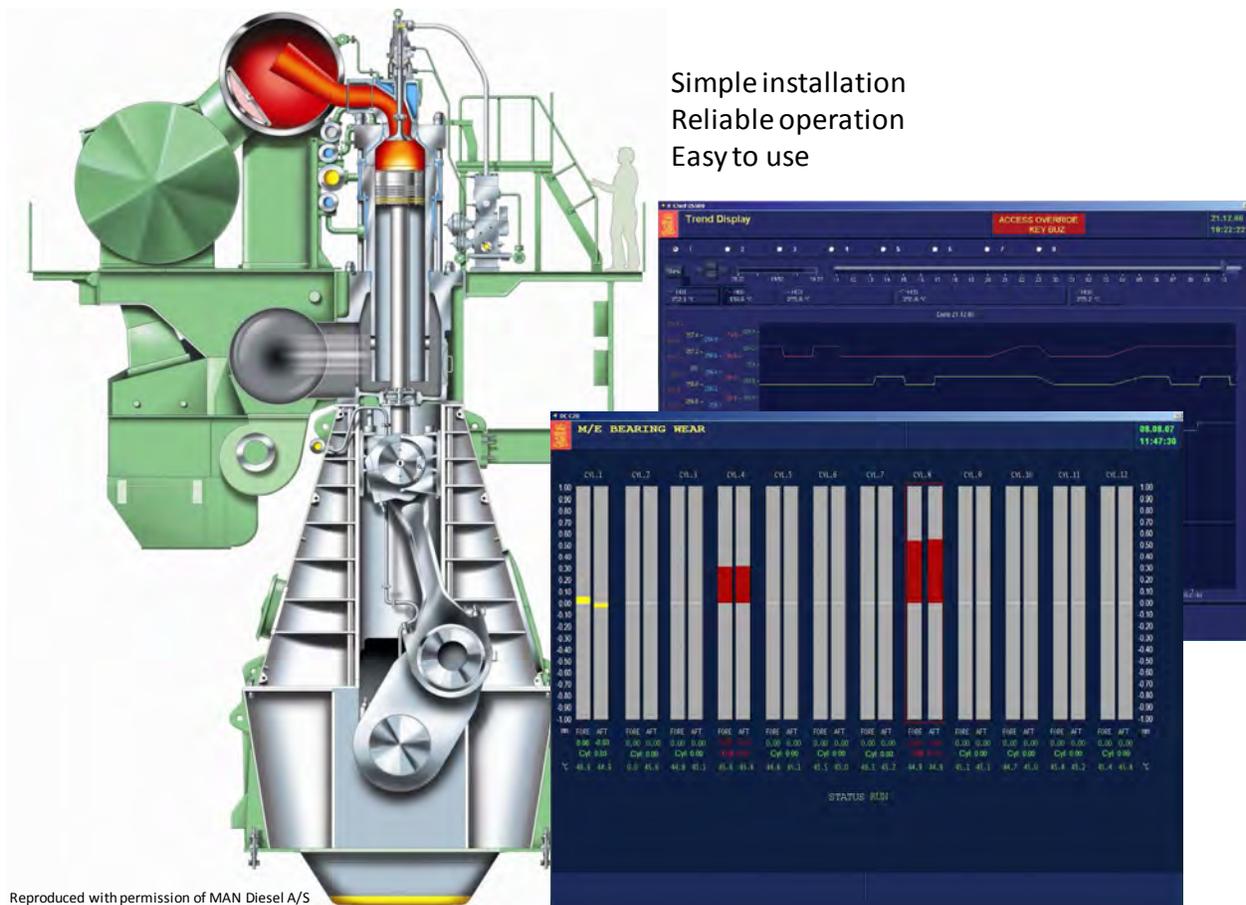


Bearing Wear Condition Monitoring (BWCM)



KONGSBERG

Necessary means to avoid open up inspection on large two-stroke diesel engines



System features

- Stand alone or fully integrated with Kongsberg K-Chief 500 and/or AutoChief C20.
- Fixed propeller or variable load solutions.
- Full compensation for manoeuvring, cargo load and engine frame temperature effects.
- Comply with latest MAN Diesel and Germanischer Lloyd requirements.

Avoid open up inspection

Required equipment to comply:

- BWCM System
- Water in Oil sensor
- Shaft Earthing Device
- Computerised Planned Maintenance System

In addition to the class approved equipment a class survey arrangement is necessary. Implementation reporting and annual reporting will be part of the agreement with the Class.

General system description

The Bearing Wear Condition Monitoring (BWCM) System has the function of predicting bearing wear in large two-stroke diesel engines before it becomes critical. The system will provide an early warning if any of the three crank-train bearings (crosshead, crank and main bearings) experience unexpected problems during ship operation.

A typical system setup is shown in Figure 1. It consists of two Bearing Wear (BW) sensors for each cylinder (fore and aft). Via the CANopen bus the sensor measurements are fed into the system communication units (DGU) where further signal filtering is performed. Presentation, trending and storing of historical data is either done via K-Chief 500 SW as a stand alone PC or integrated with the AutoChief or the K-Chief 500 AMS.

Bearing Wear Monitoring System

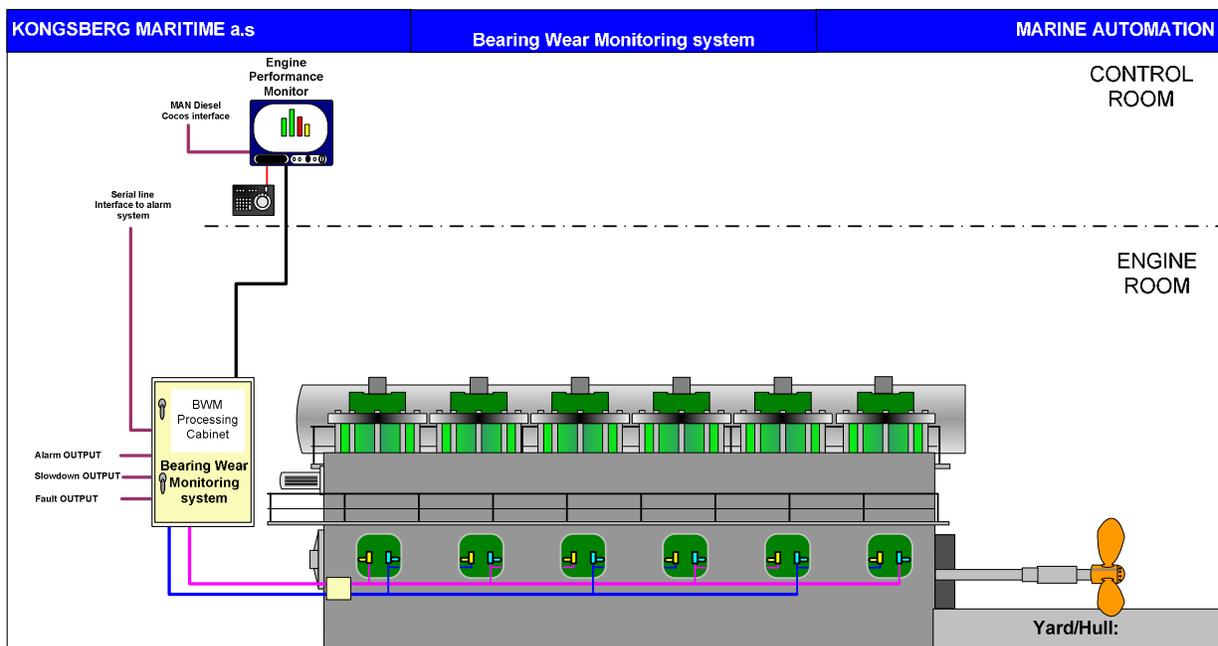


Figure 1. BWCM standalone with 15" panel computer

Sensor PS-11 description

The PS-11 sensor (see Figure 3) is based on the eddy current principle and is used for measurements against electrically conductive, ferromagnetic materials. A high-frequency alternating current flows through a coil cast in the sensor housing. The electromagnetic coil field induces eddy currents in the conductive target which alters the AC resistance of the coil. This change in impedance produces a linear electrical signal proportional to the distance of the target from the sensor.

The measurements take place every time the crosshead guide shoe passes Bottom Dead Centre (BDC) during engine running.

The sensor is sampling at a speed of 150 kHz. When the crank passes the BDC the sensor measures and detects the minimum distance between the sensor and the crosshead guide shoe. The minimum value is transmitted to the BWCM system.

To be able to determine if one or more of the bearings have sustained any wear, the sensor needs a reference value indicating normal level of crosshead guide shoe BDC. This reference BW value is measured and stored at the time of the sensor installation and commissioning.

The engine speed (RPM) will influence on the measured BW readings. Each sensors therefore measure the engine RPM and compensate the measured BW values according to RPM calibration data for each individual cylinder. The RPM compensation curves for each sensor are measured and stored during sensor commissioning on the actual engine.

Also maneuvering, cargo load condition and engine frame temperature will influence on the sensor BW measurements. These effects are handled in a deviation filter for each sensor. In addition the sensor is measuring the coil temperature and does compensation in the BW value according to measured temperature. This sensor temperature compensation is set during sensor production.

A typical sensor installation is shown on Figure 2. The sensors are mounted on special designed bracket and fixed to the engine frame beneath the crosshead guide shoe.

PS-11 installation example

The PS-11 sensor, see figure 2, (pos. 1) is mounted on a bracket (pos. 2), which is fixed beneath the crosshead guide shoe (pos. 3).

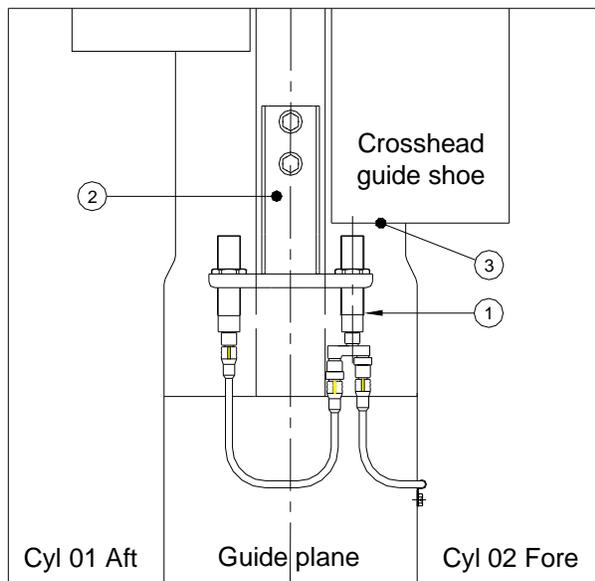


Figure 2. Mounting bracket for the PS-11 sensor



Figure 3. Picture of the PS-11 sensor

Technical specifications

Overall System Specification

Operation station	See separate data sheet for K-Chief 500
Alarm limit cylinder deviation	±0.30 mm
Alarm limit sensor deviation	±0.40 mm
Slowdown sensor deviation	±0.50 mm
Alarm limit sensor value	±0.50 mm
Slowdown sensor value	±0.70 mm
Communication alarm	Continuous monitoring of sensor communication
Failure alarm	Indicating type of fault
DGU	See separate DGU data sheet
Digital Input & Output Module RIO-C2	8Di+8Do, Application specific
Maximum no of sensors in one engine	32 sensors (16 cylinders)
Serial line	NMEA or RS485, Application specific
MAN CoCoS	Modbus TCP, Application specific

PS-11 Bearing Wear Sensor Specification

Power supply:	18 to 32 VDC, class approved type
Power consumption:	Nominal 0.8 W Max. 1 W
Output signal:	CANopen
Protection grade:	IP 67
Operating temperature:	0 to +80 °C
Storage temperature:	-20 to +80 °C
Sensor housing:	Steel pipe, material AISI 304
Weight of unit:	160 gr.
Dimensions:	Diameter/threads, M22 x 1, L = 103 mm
Mounting:	Custom bracket for each engine type
Measuring resolution – distance:	0.01 mm
Measuring accuracy – distance:	±0.05 mm
Measuring range:	0 – 6 mm
Optimal installation distance between sensor and crosshead guide shoe:	3 ±1 mm.
Sensor cable type	CANopen bus cable in accordance with UL style 21126

