Preventive maintenance

Better than cure

Operational activities constitute the major part of the lifecycle costs of marine engines. It is therefore extremely important to service them regularly and prevent problems before they happen.

Jens Lindemann, Littelfuse Selco

Engine failures disrupt the operation of a ship, creating delays and heavy additional maintenance costs. A well-maintained engine, on the other hand, operates more economically and more reliably.

Therefore, it is very important to schedule timely maintenance and avoid such failures. Brought into the engine’s condition is essential and this is what the EngineEye diagnostic tool provides. The basic version of the EngineEye consists of a handheld cylinder pressure analyzer and a piezoelectric pressure sensor, whereas the professional version includes a crank angle sensor solution in addition, providing additional information.

**Pressure measurement**

Reliable data is essential for analyzing and comparison purposes. The pressure sensor measures the cylinder pressure inside the engine. It is mounted on the indicator valve of the cylinder. After measuring one cylinder, the sensor is moved to the next, measuring the pressure inside consecutive cylinders. The EngineEye cylinder pressure analyzer shows the measurements on its display, so the user can confirm on site whether the measurement process was successful. After measurement, the results can be copied to a PC (via USB connection) and analyzed with the software that comes with the product. The results can alternatively be sent to an expert for further comparison with historical or reference data. The pressure measurement is used to create the pressure-versus-time diagram, and the pmax bar graph.

**Cylinder balancing**

The pmax bar graph shows the maximum pressure for each cylinder. This information is used for cylinder balancing (comparing the cylinder pressures with each other). On a well-adjusted engine these pressures should be the same or nearly the same in all cylinders. Deviation can cause increased vibration and excessive wear. The EngineEye can detect this early, allowing maintenance to be scheduled before the engine operation is affected.

**Detection of top dead center and crank angle**

The use of a top dead center or a crank angle sensor provides additional information on engine performance.

The top dead center sensor detects the shaft position once per revolution (one pulse per revolution). The advantage of the crank angle sensor over the top dead center sensor is the higher resolution on the crank angle measurement: changes in engine speed within one revolution are detected.

The crank angle sensor consists of a crank angle belt and an inductive sensor. The EngineEye patented belt can be cut to the required length (according to shaft diameter) and then easily mounted on the shaft. In connection with the pressure measurement, the crank angle measurement is used for creating the pressure versus crank angle and the pressure changing versus crank angle changing diagram (dp/d diagram), which both provide information on ignition timing.

**Mean indicated pressure**

From the pressure versus crank angle measurement the mean effective pressure (also called MIP/Pme) is calculated. This parameter is then used for calculating the cylinder power.

**Misfiring analysis**

For the misfiring analysis the EngineEye measures the peak firing pressures over a user-configurable number of work strokes. These measurements are saved on the cylinder pressure analyzer and can then be imported to a PC.

The PC software creates a bar graph showing the distribution of peak firing pressures. A distribution that is too wide indicates excessive misfiring, which could be a sign of poor injection timing or valve adjustment. Monitoring these firing pressures allows the scheduling of servicing before operational problems appear.

**EngineEye system**

The cylinder pressure analyzer is built into a sturdy metal housing and includes large push buttons, so it can be operated even while wearing gloves.

The patented leak-proof pressure sensor offers high temperature stability so prolonged measurements are possible. The units of the EngineEye system are delivered together in a robust suitcase, to ensure that no parts get damaged or lost. The EngineEye gives insight into the engine’s condition, providing the information necessary for planning preventive maintenance and keeping the engine running.

The simplicity of installation ensures that the data is collected and is reliable.

**About the author**

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For more information visit: www.littelfuse.com/EngineEye

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**Below:**

Assembly of crank angle belt to shaft.

**Below:**

EngineEye overview.

**Below:**

Pressure over crank angle diagram.