CYLINDER DRAIN OIL TEST KIT

Digital Test for Chemical Determination of Total Iron Content (Patent Number: 2982974) and BN Test (IMPA Code: 65 28 21)

Cylinder Drain Oil (CDO) analysis also called **Scrape Down Analysis (SDA)** with on-board testing equipment is an important method to closely monitor the wear of engine cylinder components (pistons, piston rings and cylinder liners) of two-stroke marine diesel engines. Along with routine engine inspections, **on-board measurement of iron particles in cylinder drain oil (CDO)** and the remaining **BN testing** at regular intervals with the **Cylinder Drain Oil Test Kit** of Martechnic® is crucial to directly and accurately assess the condition of cylinder lubrication in order to optimize the cylinder oil feed rate and prevent engine damage from wear and corrosion.

Different wear types of engine cylinders can lead to increased iron content in CDO:

1. **abrasive iron wear** caused by mechanical friction between piston ring package and cylinder liner → ferromagnetic iron particles;
2. **corrosive iron wear** or so-called **"cold corrosion"** (acid corrosion due to chemical reaction from combustion residues and sulphur present in the fuel oil) → non-magnetic iron salts.

The surfaces of cylinder components can be subjected to different wear mechanisms simultaneously. Therefore, it is important to regularly test cylinder drain oil samples (CDO) for the **combination of corrosive and abrasive wear**, i.e., to measure the **total iron** content besides measuring **the remaining base number (BN).** This is also required in various service letters from leading engine manufacturers.

Iron Content Determination in CDO

Martechnic® offers a digital test device **TOTAL IRON CHECK** for easy on-board CDO analysis to monitor the degree of **total iron concentration**.

The enhanced, redesigned version of the test device **TOTAL IRON CHECK** includes several updated features:

Test Device "TOTAL IRON CHECK" for determination of total, corrosive and abrasive iron content in cylinder drain oil (CDO)

1. Upgraded navigation menu with the possibility to create individual named data slots for up to 20 different cylinders units.
2. Large memory capacity: storage of 400 measured values with date and time stamps.
3. USB to serial connection for quick transfer of test results into a terminal program and further into Excel or similar software.

The principal aim of on-board testing **with TOTAL IRON CHECK** is preventive monitoring, i.e., early detection of any abnormal wear processes before serious

engine wear occurs. Thereby, early identification of unusual measurement values (e.g., gradual, but constant increase of total iron concentration as well as high amounts detected) can help to inform the engine operator about impeding damages in the engine to take a closer look at the problem and to be able to initiate appropriate countermeasures promptly.
The measurement of **total iron content** in cylinder drain oil (CDO) is based on the chemical reaction of iron present in cylinder lubricant in corroded or abrasive state and special reaction liquid. Irrespective of iron nature (corrosive and/ or abrasive) and size, all iron particles will be identified, measured and displayed by the **TOTAL IRON CHECK**. A two-chamber measuring system of the test device enables testing of two CDO samples simultaneously and helps to save time when assessing multiple samples of different cylinder units.

Test Device "TOTAL IRON CHECK" with Two Chambers for Testing Multiple Cylinder Units

Features:

- Measuring range: 15/20-1100 mg/kg (ppm)
- Measuring temperature: 70 ˚C
- Measuring time: about 20 min. for two cylinder drain oil (CDO) samples
- Measurement method: illuminance meter with LED source
- Accuracy: +/- 20 mg/kg (ppm) (confirmed repeatability of test results)

Test Device "TOTAL IRON CHECK" with USB Cable

Benefits:

- Precise semi-automatic measurement of total iron content
- Processing of two samples simultaneously (effective time-saving technique)
- Easy-to-read, digital display of test results
- Storage of the measured iron values per cylinder with date and time stamps
- Early warning of abnormal wear processes in case of regular application
- Efficient adjustment of lubrication of crosshead engines

The degree of total iron concentration that can be measured with the **TOTAL IRON CHECK** can be ranging up to 1100 mg/kg (ppm). The measured values will be automatically saved on the internal memory chip.
The presence of iron in a CDO sample can also be visually observed after the automatic measurement is completed. If the sample contains any iron, the color of the liquid in the glass vial changes to blue. The intensity of the blue color is related to the amount of iron present. The darker the hue of the fluid, the higher level of iron concentration the cylinder lubricant contains.
Additional measurement of corroded iron in a similar manner as total iron and then calculation of abrasive iron value is possible in order to find the root cause.

Remaining Base Number (BN) Measurement of the CDO

As a part of the **Cylinder Drain Oil Test Kit** Martechnic® provides a test device **TWIN CHECK 4.0** for determination **of the remaining base number (BN)** of the cylinder drain oil (CDO), which indicates the oil's remaining ability to neutralize acids.
The test device **TWIN CHECK 4.0** is offered in a modular design with several upgraded configurations: flexible replacement of constituent parts, user-friendly navigation menu, optimized measurement process, precise determination of measuring time in accordance with the measured value and automatic cut-off of measurement. Large memory capacity for data storage and USB to serial connection (terminal program) enables trend analysis and direct on-site evaluation of test results.

Digital BN Test Device "TWIN CHECK 4.0"

Interchangeable Parts of the Test Device "TWIN CHECK 4.0"

Features:

- Measuring range: 0 - 150 BN
- Measuring time: depends on the measured value (min. 2 - max. 20 min.)
- Accuracy: +/- 1 BN

Benefits:

- Applicable for all mineral oil-based fluids
- Improved design with easy-to-follow navigation menu for high accuracy measurements
- Digital read-out of test results
- Internal memory chip with average data storage of 2.5 years
- USB to serial cable connectivity for data transfer and trend analysis
- 6 modes for up to 6 various oil grades
- Maintenance and repair on board is possible

To measure the remaining BN, the two chambers of the reaction vessel of the **TWIN CHECK 4.0** get filled with the CDO sample and the reagent. After closing the device and starting the measurement, the device automatically performs a zero-point calibration, and the integrated pressure sensor uses the ambient pressure as a measurement line with a zero point. Once the procedure is completed, by shaking the test device every two minutes for 15 seconds the measuring process takes place. The pressure build-up represents the BN of the CDO. As soon as the pressure is no more increasing (i.e., the BN parameter is constant), the test device automatically stops measuring and displays the end-result. Therefore, the amount of time required for testing varies in accordance with the measured BN value.
Prior to BN measurement, it is necessary to conduct a single time calibration for each cylinder oil grade of the engine system (corresponds to the BN modes available).
Combining BN measurement with iron content analysis gives a comprehensive view of the cylinder's condition. A low measured BN indicates the oil's alkalinity reserve is nearly depleted. A high iron content in the CDO and a low BN may require an increase in the CDO feed rate or an increase in the BN value of the CDO. Conversely, a high BN and low iron content in the CDO can allow for a reduction in the feed rate or a decrease in the BN values of the CDO to avoid over-lubrication.

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