Creating a carbon-efficient operating environment

THE TSX5 SHAFT POWER METER FROM TRELLEBORG

ENHANCING SUSTAINABILITY IN MARITIME OPERATIONS

A growing number of shipowners and operators are increasingly turning to technology to optimize their operations. The importance of reducing energy consumption and greenhouse gas emissions, and improving energy efficiency is becoming increasingly apparent to shipowners. In response, they are beginning to integrate key technology pieces and electrical components that help to conserve energy and, at the same time, contribute to the bottom line. One such cost-effective and a well-proven tool is the shaft power meter, which assesses fuel consumption and vessel condition throughout its lifecycle, allowing the vessel to run at maximum efficiency and perform optimally.

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Trelleborg's TSX5 Shaft Power Meter – powered by strain gauge technology

With over 1000 systems installed on vessels ranging from the world's largest bulk carriers to fast naval patrol vessels, Trelleborg's TSX5 Shaft Power Meter is a well-proven system that can be fitted to a wide range of shaft sizes, from 150mm to 1,000mm.

The TSX5 Shaft Power Meter from Trelleborg helps to reduce fuel consumption and emissions, helping to create a more sustainable operating model.

The TSX5 Shaft Power Meter utilizes strain gauge technology applied to the surface of the intermediate shaft, and is considered to be the most accurate method of calculating torque. The engine and gearbox apply torque to the shaft, while resistance from the propeller applies drag. The combination of torque and resistance twists the shaft, causing surface strain to increase and the strain gauge to deform, resulting in a change in its electrical resistance, from which an accurate measurement of strain is calculated.

The change in resistance from the strain gauge is measured by a rotor board unit, which is housed in the rotor ring clamped to the shaft. Additionally, the rotor ring protects the strain gauge from damage. The rotor board unit conditions and processes the information from the strain gauge and then wirelessly transmits the signal to a processing cabinet, adjacent to the shaft, for calculating shaft torque and power.

Remote display panels mounted in the ECR or bridge report the values for shaft power, torque, rpm, and shaft direction. Thrust can also be measured by the fitting of additional strain gauges. The TSX5 system can also be interfaced to the ship's DCS and IAS, and to an external ship performance monitoring system, for example Trelleborg's own Ship Performance Monitoring System.

The TSX5 forms part of an EEXI compliant ShaPoLi system in accordance with the requirements of MEPC.335(76).

Consequently, vessel owners will see a greater return on investment from reduced fuel costs. Through our expertise in providing quality products to meet the ever-evolving needs of our customers, we help them achieve efficiency gains that would otherwise be impossible.

Over 1000 Trelleborg Shaft Power Meters installed.

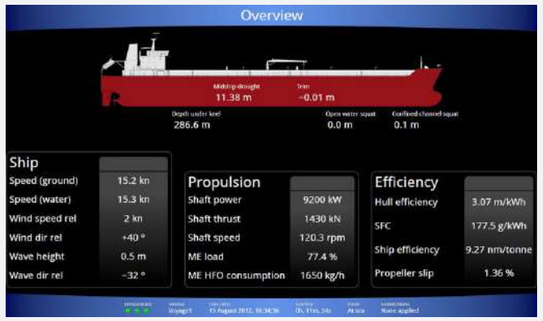
The role of shaft power meters in vessel performance and compliance with industry regulations

ENHANCED FUEL EFFICIENCIES AND EMISSIONS CONTROL

A shaft power meter is a critical hardware component for any ship performance monitoring system

Shipowners are deploying these monitoring systems to help improve ship operating efficiencies and to create automated reports. When combined with fuel consumption and ship speed, the power readings can be used for reporting hull, ship, and fuel efficiencies, as well as data for Energy Efficiency Operational Index (EEOI) and ISO19030 reporting.

By generating these reports, shipowners can make data-driven decisions on when to clean hulls and propellers, avoiding excessive fouling, while lowering fuel consumption and reducing engine emissions. This in turn lowers OPEX, while providing a quick return on investment.



Data collected by a shaft power meter can be useful in measuring efficiency and saving fuel and emissions (source: Trelleborg)

EARLY WARNINGS OF INEFFICIENCIES

Accurately measuring shaft power to water requires the use of a power meter to quantify shaft torque. Power and torque are calculated through the real-time measurement of surface strain.

A direct measurement of shaft power is more accurate than engine estimations, allowing shipowners to identify efficiency savings

When shaft power is measured directly, it provides an early indication of increasing power requirements which cannot be identified through theoretical calculations derived from test-house power curves.

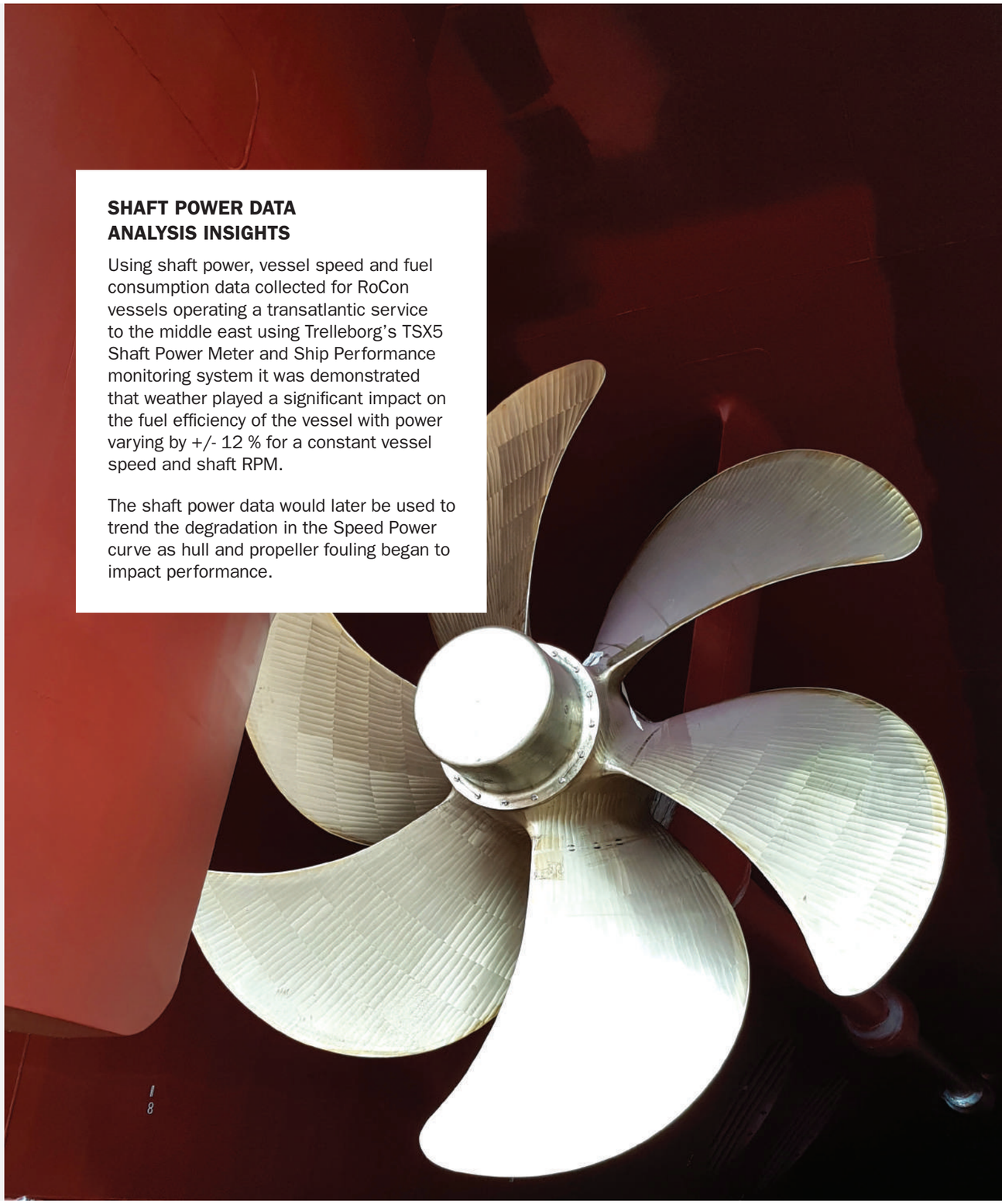
When comparing performance against base-line data, shaft power meters can provide early warnings of deteriorating operating conditions by highlighting increasing power usage, which leads to higher fuel consumption and emissions, as well as higher OPEX.

DATA-DRIVEN DECISIONS

Severe hull and propeller fouling pose major risks, potentially increasing fuel consumption and engine emissions by over 50%.

Installing a shaft power meter makes it possible to detect the effects of fouling early and take preventative action as soon as possible

Furthermore, it allows accurate monitoring of the before-and-after effects of antifouling technologies applied to the hull or propeller. Shipowners can make data-driven decisions on when to clean hulls and propellers.



SHAFT POWER DATA ANALYSIS INSIGHTS

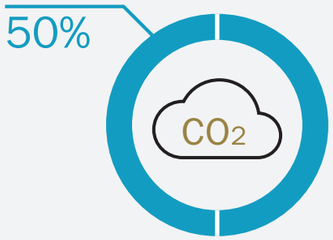
Using shaft power, vessel speed and fuel consumption data collected for RoCon vessels operating a transatlantic service to the middle east using Trelleborg's TSX5 Shaft Power Meter and Ship Performance monitoring system it was demonstrated that weather played a significant impact on the fuel efficiency of the vessel with power varying by +/- 12 % for a constant vessel speed and shaft RPM.

The shaft power data would later be used to trend the degradation in the Speed Power curve as hull and propeller fouling began to impact performance.

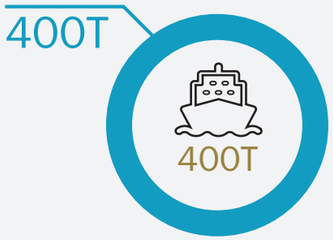
TSX5 Shaft Power Meter compliance with EEXI

EEXI COMPLIANCE

WORKING TOWARDS 50% CO_2 REDUCTION BY 2050



APPLIES TO SHIPS OF 400 GROSS TONNAGE AND ABOVE



100% OF VESSELS HAVE TO COMPLY BY 31st DECEMBER 2023

On 17 June 2021, the IMO adopted amendments to MARPOL Annex VI at MEPC 76, introducing regulations 23 and 25 – the Efficiency Existing Ship Index (EEXI), marking the first step towards the sector's goal of reducing carbon emissions by 50% by the year 2050.

All existing ships must meet the target EEXI score, which varies by type. First, each ship must calculate its attained EEXI score, as per MEPC.333(76), and determine whether it meets the required score. In the event it does not, the ship must take action before compliance can be demonstrated. On or after 1 January 2023, compliance must be demonstrated in accordance with MEPC.334(76) at the time of the IAPP survey and during the annual, intermediate, or renewal survey, whichever occurs first.

The IMO has prescribed two methods for improving a ship's EEXI score for its main engines in accordance with MEPC.335(76): Engine Power Limitation (EPL) and Shaft Power Limitation (ShaPoLi).

The ShaPoLi method involves the measurement of shaft power, torque and speed that is either fed back to the engine management system to limit power in accordance with the regulations or to the Officer of Watch who can manually reduce speed to limit power.

Trelleborg's TSX5 provides the power and torque data that is needed to be able to calculate EEXI for a vessel as part of a ShaPoLi based system.

The ShaPoLi method can be used as an alternative to the EPL method for all engine types and propeller set ups. This method also has a distinct advantage for ships with four-stroke engines and multi consumers where limiting engine power using the EPL method will result in power being reduced to all consumers. By measuring shaft power to the propeller and limiting only this consumer, the ship can comply with EEXI requirements, while keeping the rest of the configuration unchanged.

*EEXI regulation applies to ships of 400 gross tonnage and above, and whose ship type falls into one or more of the categories in regulation 2 of MARPOL Annex VI.

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

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