K-Chief Vessel Performance System

KONGSBERG

Fuel Performance Monitoring

Engine Performance Monitoring

Energy Management

Kongsberg's extensive experience and knowledge in navigation, propulsion and machinery control systems have made us capable of designing a modular vessel performance concept, which contributes to improved fuel efficiency and reduced emissions.

In order to optimize the total energy consumption of the ship, the **Kongsberg Vessel Performance System** (VPS) addresses specific areas for improvement, such as engine optimization, speed profile, optimal trim, speed and rpm/pitch – thereby also reducing operating costs. The system has been installed and proven successful on various types of ships.

The Kongsberg VPS provides a set of tools that enable ship operators to manage their vessels in a more economical and environmentally beneficial way, all in compliance with the present safety regulations.

The Kongsberg VPS can be delivered as an integrated part of the K-Chief 600 automation system, or as a stand-alone system, with independent operator stations. The system offers a user-friendly human-machine interface and a practical selection of process pictures.

System modules

The Kongsberg VPS is based on our highly distributed and modular automation technology. The system concept comprises three main modules:

- Fuel Performance Monitoring
- Engine Performance Monitoring
- Energy Management

Fuel Performance Monitoring

This module is designed to give the operator a tool for monitoring the fuel consumption. By aiming specifically at the propulsion system, the operator receives invaluable information on the most economical operation. The module provides an overview of the propeller, shaft and main engine. Based on the acquired measurements, a set of performance parameters is calculated, including:

- Momentary fuel consumption for each engine in kg/hrs
- Total momentary fuel consumption in kg/hrs
- Hull efficiency in kg/NM
- Engine efficiency for each engine in g/kWh
- Shaft power for each shaft in MW
- Total shaft power in MW
- Duration of voyage in hrs
- Distance traveled in NM
- Accumulated fuel consumption for each engine in tons
- Total accumulated fuel consumption in tons
- Accumulated propeller shaft power for each shaft in MWh
- Total accumulated propeller shaft power in MWh

Benefits of fuel performance monitoring:

- Continuous measurements of fuel consumption and engine power output
- Monitoring of parameters for improving the vessel's overall performance

The Kongsberg MetaPower® torque system measures torque on the rotating shaft. The system's patented optical technology provides high accuracy and long term stability.

Reliable flow (mass) meters, having accuracy better than ±0.25 %, shall be installed to ensure successful consumption measurements of fuel oil and diesel oil. Flow meters can be supplied by Kongsberg, if required.

Engine Performance Monitoring

This module is designed to give the operator instantaneous status of the engines' operational performance.

By advanced cylinder pressure measurements, subsequent analysis of the combustion process offers diagnosis algorithms based on empirical results and physical models. The module will give engine status and hints based on expert advices. Changing of fuel quality is a challenge, to which the analysis tool provides a detailed guide for adjustments and tuning of the engines.

Based on the combustion process analysis, torque measurements, fuel quality and fuel consumption, the emission of CO_2, NO_X and SO_X can be calculated.

Benefits of engine performance monitoring:

- Reduction of fuel consumption
- Monitoring of cylinder load
- Calculation of CO_2, NO_X and SO_X
- Reduction of maintenance costs and improved planning of maintenance
- Reduced risk for engine damage

The main engine will normally be equipped with fixed (on-line) combustion pressure sensors, whilst one portable (off-line) combustion pressure sensor will be employed for each auxiliary engine.

Energy Management

These modules are designed to give the operator systematic methods to measure, register and analyze the energy usage of the ship. This approach identifies specific actions that operators can take in order to reduce energy consumption. The primary objective of the methodology is to optimize the use of fuel and minimize environmental effects.

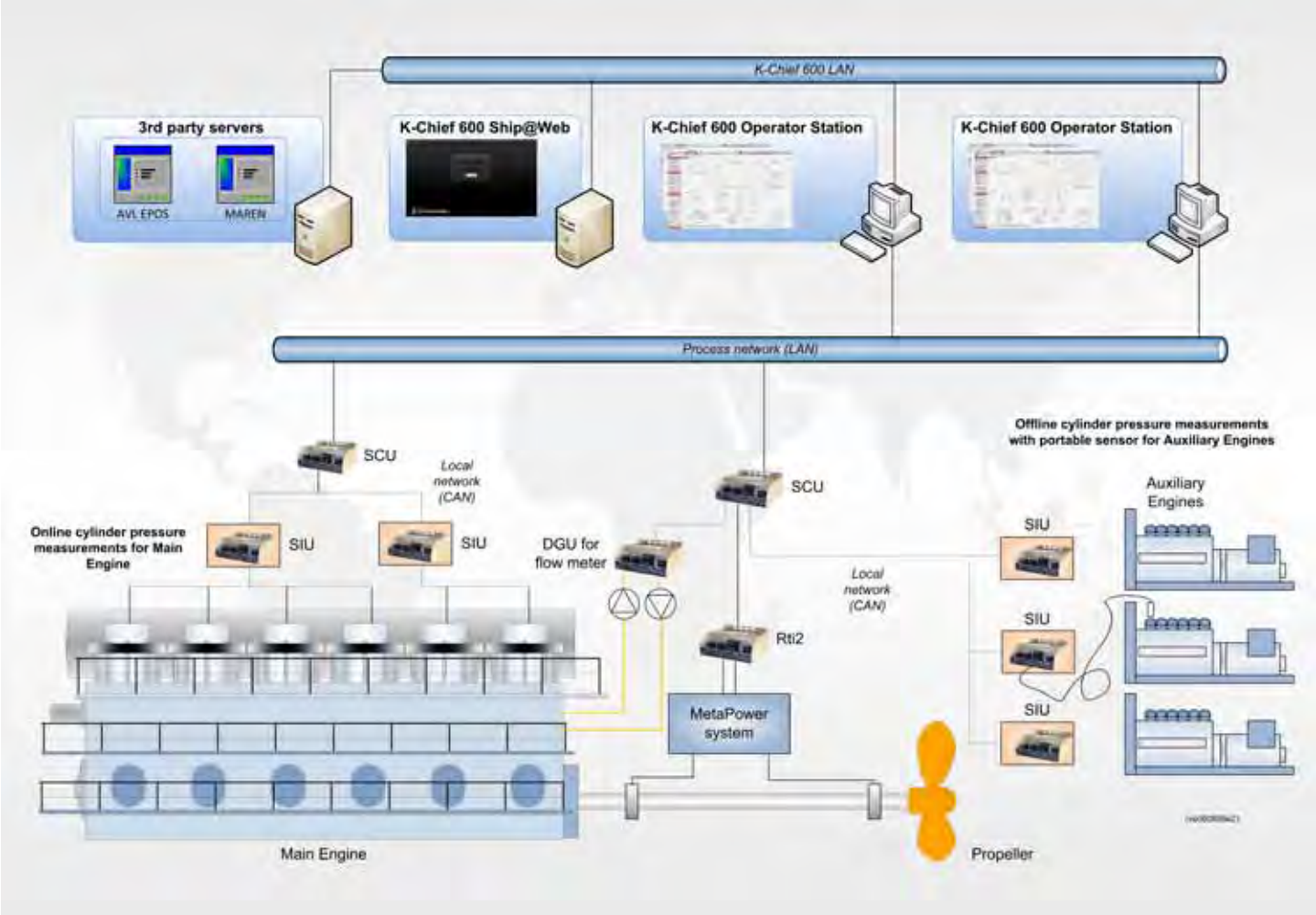
Other objects are to increase knowledge regarding energy issues, maintain effective monitoring and reporting of fuel usage and reduce risk of discontinued service of energy systems.

The Energy Management system has the ability to connect to a shore portal. This is a web based on-shore fleet management system that makes ships' operational information available to stakeholders throughout the shore organization. The portal allows for on-shore reporting, monitoring and comparison of sister ships or of an entire fleet.

Benefits of energy management:

- Fuel savings
- Reduced emissions
- A complete operational overview
- Decision support
- Reliable and clear reports
- Operational history
- Voyage tracking
- Inventory overview
- Calculation of CO_2, NO_x and SO_x

Typical system configuration



Kongsberg MetaPower® system, optical sensors installed on the rotating shaft

The Segment Controller Unit - a member of the Kongsberg Distributed Processing Unit family

Cylinder pressure sensor used for monitoring of diesel or gas engines

The **Vessel Performance Operator Stations** can typically be located in the navigation planning station or in the Master and Chief Engineer's offices.

The **K-Chief 600 automation system's Operator Stations** shall be located in the engine control room.

The **Ship@Web Server** provides K-Chief 600 services on the ship's administrative network. This is based on a secure and safe communication structure.

Kongsberg's **Distributed Processing Units** are designed to monitor analogue and digital sensors.

The Distributed Processing Units employed by the Vessel Performance System are:

- The **Segment Controller Unit** - a dual four channel CAN gateway
- The **Sensor Interface Unit** - an interface unit for up to four cylinder pressure sensors
- The **Remote Torque Interface Unit** - an interface unit for the MetaPower® torque system

Typical configuration alternatives

Fuel Performance Monitoring module

- K-Chief 600 Operator Station(s)
- Kongsberg MetaPower® torque system
- Mass flow meters for main and auxiliary engines
- Fuel Performance software

Engine Performance Monitoring module

- K-Chief 600 Operator Station(s)
- Vessel Performance Operator Station(s)
- Ship@Web Server
- Fixed cylinder pressure sensors for main engine
- Portable cylinder pressure sensors for auxiliary engines
- Engine Performance software

Energy Management modules

- K-Chief 600 Operator Station(s)
- Vessel Performance Operator Station(s)
- Ship@Web Server
- A selection of Energy Management software modules

Note! This datasheet is subject to change without prior notice.

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