The First Commercial ME Engine

After a highly successful experience with the prototype 6L60MC/ME engine, Odfjell ASA, Norway, commissioned the World's first dedicated ME engine, a 7S50ME-C, from MAN B&W Diesel's Frederikshavn Works.

This particular engine will be installed into a newbuilding, KF 144. It is destined to power a chemical carrier being built by the Kleven Florø yard, Norway. MAN B&W Diesel are also supplying the GenSets and Controllable Pitch Propeller systems for the ship.

Unlike the prototype, this engine was designed and built without a camshaft – making it a truly cam-less engine. The functions of the camshaft have now been taken over by a fully integrated and computer controlled electro-hydraulic Engine Control System (ECS).

The ECS system controls the timing of the fuel injection through close monitoring of the crankshaft position via a tacho system, which is far more accurate and responsive than any mechanical method of control. This results in savings in fuel and lube oil consumption and at the same time gives greater manoeuvring control.

In addition to this highly efficient and controllable system, other MAN B&W Diesel innovations have also been integrated into this electronic engine. The Alpha Lubricator ACC has also been specified in addition to the CoCoS-EDS – the very successful engine monitoring and diagnostic system from MAN B&W Diesel.

The most visually different aspect of this engine, when compared to the older designs, is the removal of the timing chains. This change, in combination with the removal of the camshaft, has resulted in weight savings. In addition to this being a compact engine, hence the designation ME-C, the removal of the chains also gives the opportunity to further reduce the overall length of the engine.

Fig. 1: Completed – the first commercial ME engine

Bow Firda					
Owner:	Odfjell ASA	Dimensions:		kW:	10,430
Yard:	Kleven Florø	Length:	10.25 m	kW (Cyl.):	1,490
Ship type:	Chemical tanker	Width:	4.75 m	RPM:	120
Build No.:	KF144	Height:	9.33 m	MEP:	19
Engine type:	7S50ME-C	Mass:	235 tons	Propeller:	VBS 1560
				Control:	Alphatronic 2000

What is a cam-less engine

In this engine, the camshaft functions are replaced by an electronically controlled set of actuators. These actuators control the Starting air valves, Start and Reversing sequences, Governor function, Auxiliary blowers, Electronically Profiled Injection (EPIC) and Exhaust valve actuation. This is done with far greater precision than camshaft-controlled engines.

The exhaust valves, as on the MC engines, are opened hydraulically and closed by an 'air spring'. The actuator is hydraulically driven by pressurised control oil via an on/off type valve.

The Starting air distributor has now been replaced by electronically controlled on/off valve which, in conjunction with the ECU and the CCU, control the Starting air valves.

The hydraulic power is provided by the Hydraulic Power Supply units placed at the aft end of the engine.

The cam-less system, being electronically controlled, is fully integrated with other MAN B&W Diesel developments such as more efficient fuel and lube oil injection and the CoCoS engine diagnostic platform. This control makes the overall optimisation of each system even more effective and reliable.

The ECS can fully control and optimise the combustion process at any load by electronically controlling the valves according to the crankshaft position.

Electronic Control

The engine is controlled and monitored via the ECS. This platform encompasses several integrated units: the Engine Interface Control Units (EICU), Engine Control Units (ECU), Auxiliary Control Units (ACU) and Cylinder Control Units (CCU).

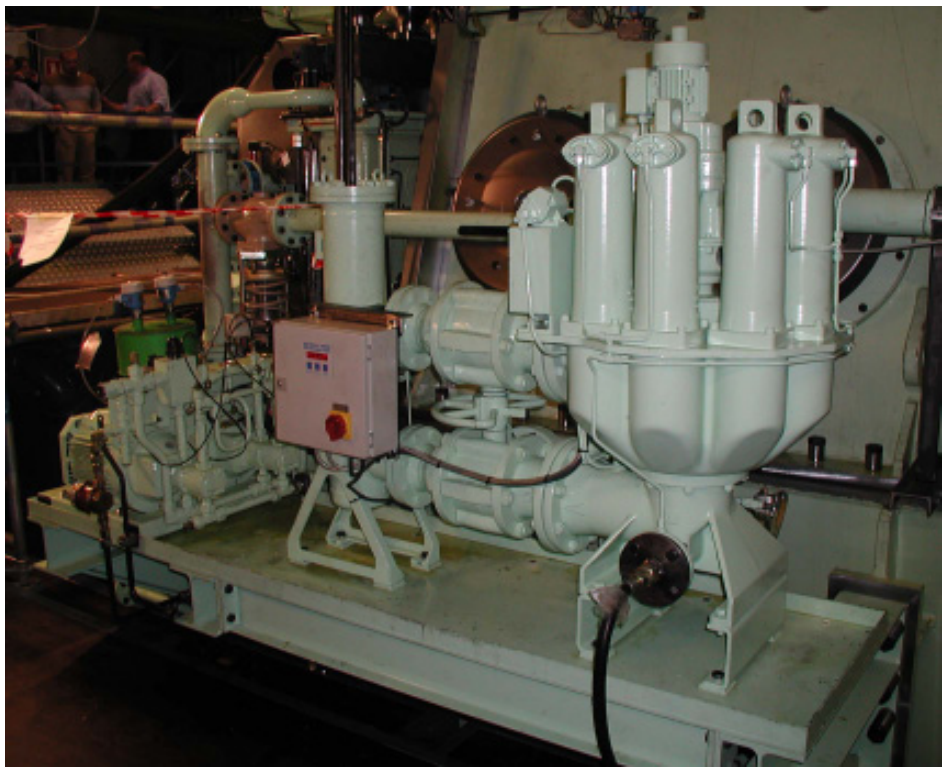

Fig. 2: Hydraulic power supply filtration unit

- The EICUs handle the interface to external systems.
- The ECUs perform engine control functions: engine speed, running modes and start sequence.
- The ACUs control the hydraulic power supply and auxiliary blower pumps.
- The CCUs control fuel injection, valve actuators and starting air valves.

Reductions in the Specific Fuel Oil Consumption (SFOC) are achieved at part load. This is due to the maximum pressure being maintained over a wider load range and without overloading the engine.

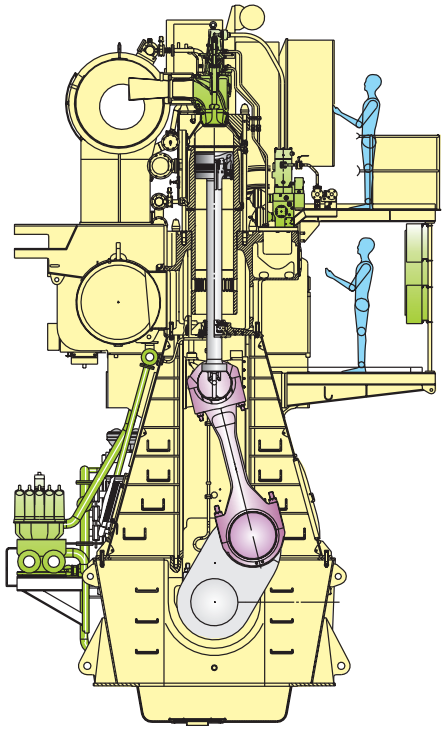

Fig. 3: Cross section – the first commercial ME engine

Alpha Lubricator ACC

Alpha ACC allows the cylinder oil dosage (g/bhph) to be controlled in such a way that it is proportional to the amount of sulphur (g/bhph) entering the cylinder with the fuel.

This is achieved by making the cylinder oil dosage proportional to the sulphur percentage in the fuel and to the engine load (fuel amount).

The main element of the cylinder liner wear is of a corrosive nature, and the amount of neutralising alkalinic components needed in the cylinder will therefore be proportional to the amount of sulphur (which generates sulphurous acids) entering the cylinders.

A minimum cylinder oil dosage is set in order to satisfy other requirements of a lubricant, such as providing an adequate oil film and detergency properties.

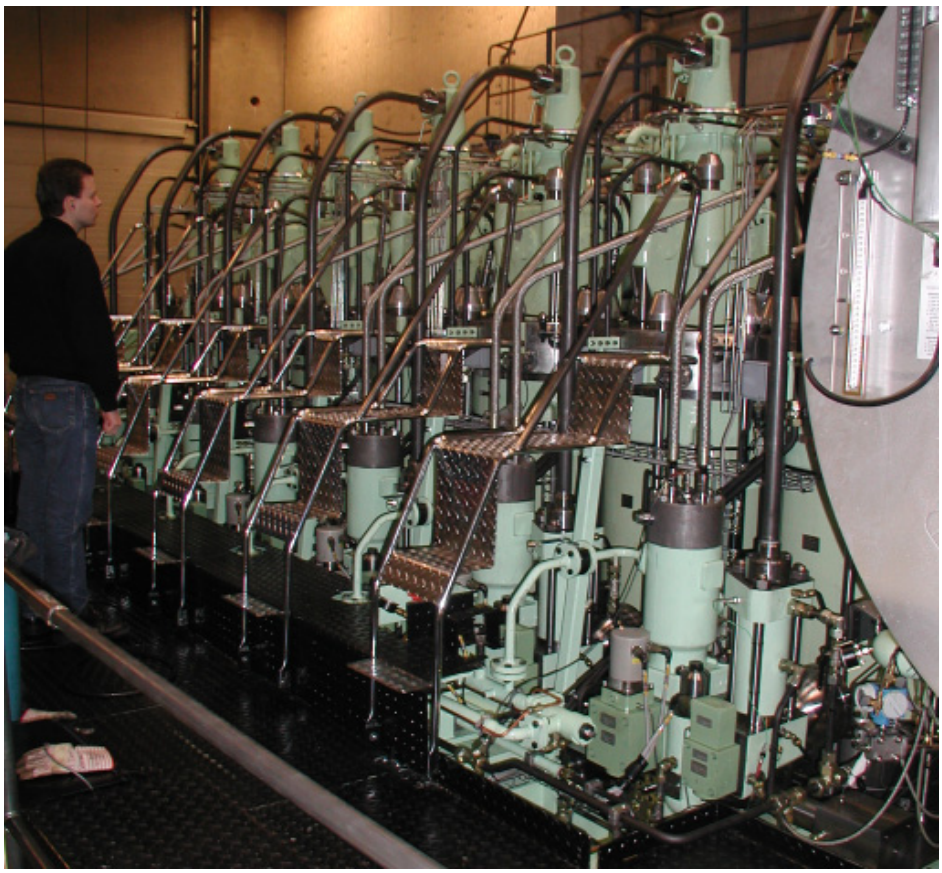

Fig. 4: Top of engine

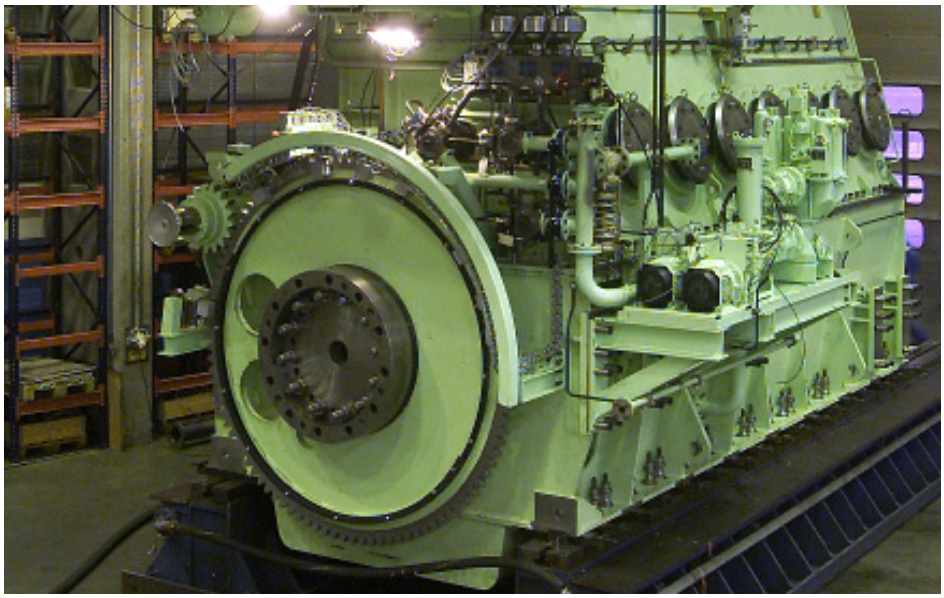

Fig. 5: Tacho system and hydraulic power supply system

Computer Controlled Surveillance System (CoCoS)

The CoCoS system has been specified as the engine monitoring, diagnostic and maintenance overview system on this engine. It is a comprehensive collection of MAN B&W Diesel-developed software, which is designed to detect various data, determined through the alarm system as well as other sensors in order to keep the engine working in its optimum state.

The CoCoS system's four major programme groups consist of: the Engine Diagnostic System (EDS), a Maintenance Planning System (MPS), a Stock Handling and Spare Parts Ordering

Fig. 6: Fore end of 7S50ME-C engine

(SPO) facility and the Spare Parts Catalogue (SPC).

The EDS continually monitors all stored operating parameters for the entire lifetime of the engine, and provides a warning to the attendant staff if it suspects a problem is developing. If a problem is likely to occur, the appropriate work can be scheduled through the MPS, perhaps to coincide with other planned maintenance work. The MPS normally shows scheduled maintenance work together with timing instructions, list of required tools, spare parts and manpower requirements.

While scheduling maintenance, the SPO system automatically checks whether the spare parts are available (while allowing for a minimum and safety reserve), and the SPC gives the opportunity for the staff to display them (either in graphical or textual form).

The aim of the system is to prevent longer than necessary off-service repair time by increasing the engine's availability and reliability, thus reducing operational costs. Additional savings can also be achieved through the appropriate scheduling of maintenance and spare parts ordering.

PMI System

The PMI system is a computerised tool for evaluation cylinder pressures in MAN B&W Diesel engines. It consists of a hand held transducer and control unit, which interfaces with a PC.

A single operator can collect and display a complete set of measurements in less than fifteen minutes. It uses a high performance piezo-electric pressure transducer and an advanced crankshaft angle trigger system for determining the TDC of each cylinder to reliably and precisely measure cylinder pressures.

The cylinder pressure data is presented as easy-to-interpret measurement curves on the PC as well as in tabular form. By calculating the max. pressure deviation of each cylinder and computing index settings for balanced output from all cylinders, the engine output can be adjusted for enhanced performance.

The system automatically calculates effective power, mean indicated pressure p_i , and gives proposals for fuel pump index adjustments.

Alphatronic 2000 Control System

This electronic propulsion control system for ships with CP propellers enables the navigator to manoeuvre the ship from the bridge. This can be done without consideration for engine load conditions as the system automatically enacts an overload protection. The propulsion control can be transferred at any time to other control areas such as the bridge wing or control room panel. A separate emergency back-up system, as required by the major classification societies, maintains a pre-set engine speed and propeller pitch, and is physically integrated into the control panel.