ME-B Mark 9 Engine description

General

Please note that engines built by our licensees are in accordance with the drawings and standards of Everllence. In certain cases local standards may be applied but all spare parts are interchangeable with parts designed by Everllence.

Some components may differ from Everllence' design because of local production facilities or the application of local standard components.

Bedplate and main bearing

The bedplate is made with the thrust bearing in the aft end of the engine. The bedplate is of the welded design and the normally cast part for the main bearing girders is made from either rolled steel plates or cast steel. Alternatively, the S35 is specified with a fully cast bedplate design.

For fitting to the engine seating in the ship, long, elastic holding-down bolts and hydraulic tightening tools are used.

The bedplate is made without taper for engines mounted on epoxy chocks.

The oil pan is made of steel plate and is welded to the bedplate except on S35 with fully cast bedplate to which the oil pan is bolted. It collects the return oil from the forced lubricating and cooling oil system. The oil outlets from the oil pan are normally vertical and are provided with gratings.

Horizontal outlets at both ends can be arranged for some cylinder numbers, however this must be confirmed by the engine builder.

The main bearings consist of thin walled steel shells lined with bearing metal. The main bearing bottom shell can be rotated out and in by means of special tools in combination with hydraulic tools for lifting the crankshaft. The shells are kept in position by a bearing cap.

Frame Box

The frame box is normally of the welded design. As an alternative, the S35 is specified with a cast frame box.

On the exhaust side, the frame box is provided with relief valves for each cylinder. On the manoeuvering side, it is provided with a large hinged door for each cylinder.

The framebox is of the well-proven triangular guide-plane design with twin staybolts giving excellent support for the guide shoe forces.

Cylinder frame and stuffing box

For the cylinder frame, two possibilities are available:

- Nodular cast iron
- Welded design with integrated scavenge air receiver.

The cylinder frame is provided with access covers for cleaning the scavenge air space, if required, and for inspection of scavenge ports and piston rings from the manoeuvering side. Together with the cylinder liner it forms the scavenge air space.

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The cylinder frame is fitted with pipes for the piston cooling oil inlet. The scavenge air receiver, turbocharger, air cooler box and gallery brackets are located on the cylinder frame. At the bottom of the cylinder frame there is a piston rod stuffing box, provided with sealing rings for scavenge air, and with oil scraper rings which prevent crankcase oil from coming up into the scavenge air space.

Drains from the scavenge air space and the piston rod stuffing box are located at the bottom of the cylinder frame.

Cylinder liner

The cylinder liner is made of alloyed cast iron and is suspended in the cylinder frame with a low-situated flange. The top of the cylinder liner is fitted with a cooling jacket. The cylinder liner has scavenge ports and drilled holes for cylinder lubrication.

The Piston Cleaning ring (PC-ring) is installed between the liner and the cylinder cover, scraping off excessive ash and carbon formations from the piston topland.

Cylinder liners prepared for installation of temperature sensors are available as an option.

Cylinder cover

The cylinder cover is of forged steel, made in one piece, and has bores for cooling water. It has a central bore for the exhaust valve, and bores for the fuel valves, a starting valve and an indicator valve.

The cylinder cover is attached to the cylinder frame with studs and nuts tightened with hydraulic jacks.

Crankshaft

The crankshaft is of the semi-built type, made from forged or cast steel throws. For engines with 9 cylinders or more, the crankshaft is supplied in two parts.

At the aft end, the crankshaft is provided with the collar for the thrust bearing, the flange for the turning wheel and for the coupling bolts to an intermediate shaft.

At the front end, the crankshaft is fitted with the collar for the axial vibration damper and a flange for the fitting of a tuning wheel. The flange can also be used for a power take off, if so desired.

Coupling bolts and nuts for joining the crankshaft together with the intermediate shaft are not normally supplied.

Thrust bearing

The propeller thrust is transferred through the thrust collar, the segments, and the bedplate, to the end chocks and engine seating, and thus to the ship's hull.

The thrust bearing is located in the aft end of the engine. The thrust bearing is of the B&W-Michell type, and consists primarily of a thrust collar on the crankshaft, a bearing support, and segments of steel lined with white metal.

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The thrust shaft is an integrated part of the crankshaft and it is lubricated by the engine's lubricating oil system.

Everllence flexible thrust cam design is used for the thrust collar on a range of engine types.

Turning gear and turning wheel

The turning wheel is fitted to the thrust shaft, and it is driven by a pinion on the terminal shaft of the turning gear arrangement, which is mounted on the bedplate.
The turning gear is driven by an electric motor with a built-in brake.

A blocking device prevents the main engine from starting when the turning gear is engaged. Engagement and disengagement of the turning gear is done manually by moving the pinion.

The control device for the turning gear, consisting of starter and manual control box, is included in the basic design.

Axial vibration damper

The engine is fitted with an axial vibration damper, mounted on the fore end of the crankshaft. The damper consists of a piston and a split-type housing located forward of the foremost main bearing.

The piston is made as an integrated collar on the main journal, and the housing is fixed to the main bearing support.

For functional check of the vibration damper a mechanical guide is fitted, while an electronic vibration monitor can be supplied as an option.

An axial vibration monitor with indication for condition check of the axial vibration damper and terminals for alarm and slow down is required for engines Mk 9 and higher.

Tuning wheel / Torsional vibration damper

A tuning wheel or torsional vibration damper may have to be ordered separately, depending on the final torsional vibration calculations.

Connecting rod

The connecting rod is made of forged or cast steel and provided with bearing caps for the crosshead and crankpin bearings.

The crosshead and crankpin bearing caps are secured to the connecting rod with studs and nuts tightened by means of hydraulic jacks.

The crosshead bearing consists of a set of thin-walled steel shells, lined with bearing metal. The crosshead bearing cap is in one piece, with an angular cut-out for the piston rod.

The crankpin bearing is provided with thin-walled steel shells, lined with bearing metal. Lube oil is supplied through ducts in the crosshead and connecting rod.

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Piston

The piston consists of a piston crown and piston skirt. The piston crown is made of heat-resistant steel and has four ring grooves which are hard-chrome plated on both the upper and lower surfaces of the grooves.

The piston is bore-cooled and with a high topland.

The piston ring pack is No. 1 piston ring, high CPR (Controlled Pressure Relief), Nos. 2 to 4, piston rings with angle cut. All rings are with Alu-coat on the running surface for safe running-in of the piston ring.

The uppermost piston ring is higher than the others. The piston skirt is of cast iron with a bronze band.

Piston rod

The piston rod is of forged steel and is surface hardened on the running surface for the stuffing box. The piston rod is connected to the crosshead with four bolts. The piston rod has a central bore which, in conjunction with a cooling oil pipe, forms the inlet and outlet for cooling oil.

Crosshead

The crosshead is of forged steel and is provided with cast steel guide shoes with white metal on the running surface.

The guide shoe is of the low friction type and crosshead bearings of the wide pad design.

The telescopic pipe for oil inlet and the pipe for oil outlet are mounted on the guide shoes.

Scavenge air system

The air intake to the turbocharger takes place directly from the engine room through the turbocharger intake silencer. From the turbocharger, the air is led via the charging air pipe, air cooler and scavenge air receiver to the scavenge ports of the cylinder liners, see Chapter 14.

Scavenge air cooler

For each turbocharger a scavenge air cooler of the mono-block type is fitted.

The scavenge air cooler is most commonly cooled by freshwater from a central cooling system. Alternatively, it can be cooled by seawater from either a seawater cooling system or a combined cooling system with separate seawater and freshwater pumps. The working pressure is up to 4.5 bar.

The scavenge air cooler is so designed that the difference between the scavenge air temperature and the water inlet temperature at specified MCR can be kept at about 12 °C.

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Auxiliary blower

The engine is provided with electrically-driven scavenge air blowers integrated in the scavenge air cooler. The suction side of the blowers is connected to the scavenge air space after the air cooler.

Between the air cooler and the scavenge air receiver, non-return valves are fitted which automatically close when the auxiliary blowers supply the air.

The auxiliary blowers will start operating consecutively before the engine is started in order to ensure sufficient scavenge air pressure to obtain a safe start.

The auxiliary blower design is of the integrated type.

Further information is given in Chapter 14.

Exhaust gas system

From the exhaust valves, exhaust gas is led to the exhaust gas receiver where the fluctuating pressure from the individual cylinders is equalised, and the total volume of gas is led to the turbocharger(s). After the turbocharger(s), the gas is led to the external exhaust pipe system.

Compensators are fitted between the exhaust valves and the receiver, and between the receiver and the turbocharger(s).

The exhaust gas receiver and exhaust pipes are provided with insulation, covered by galvanised steel plating.

A protective grating is installed between the exhaust gas receiver and the turbocharger.

Exhaust turbocharger

Three turbocharger makes are available for the ME-B engines, i.e. Everllence, Accelleron and MHI. As an option on type 50 dot 3 engines only, Everllence TCA turbochargers can be delivered with variable nozzle area technology that reduces the fuel consumption at part load by controlling the scavenge air pressure.

The turbocharger selection is described in Chapter 3, and the exhaust gas system in Chapter 15.

Camshaft and cams

The camshaft is made in one piece with exhaust cams.

The exhaust cams are made of steel, with a hardened roller race, and are shrunk onto the shaft. They can be adjusted and dismantled hydraulically.

The camshaft bearings consist of one lower halfshell fitted in a bearing support. The camshaft is lubricated by the main lubricating oil system.

Chain drive

The camshaft is driven from the crankshaft by a chain drive, which is kept running tight by a manually adjusted chain tightener. The long free lengths of chain are supported by rubber-clad guidebars and the chain is lubricated through oil spray pipes fitted at the chain wheels and guidebars.

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2nd order moment compensators

A 2nd order moment compensator is in general relevant only for 5 or 6-cylinder engines type 50. When needed, an external electrically driven moment compensator type RotComp or similar can be installed in the steering room.

The 2nd order moment compensators as well as the basic design and options are described in Section 17.02.

Hydraulic cylinder unit

The hydraulic cylinder unit (HCU) consists of a base plate on which a distributor block is mounted. The distributor block is fitted with one accumulator to ensure that the necessary hydraulic oil peak flow is available for the Electronic Fuel Injection.

The distributor block serves as a mechanical support for the hydraulically activated fuel pressure booster.

There is one Hydraulic Cylinder Unit per two cylinders. The HCU is equipped with two pressure boosters, two ELFI valves and two Alpha Lubricators. Thereby, one HCU is operating two cylinders.

The hydraulic power supply

The Hydraulic Power Supply (HPS) is installed in the front end of the engine. The HPS is electrically driven and consists of two electric motors each driving a hydraulic pump.

The pressure for the hydraulic oil is 300 bar. Each of the pumps has a capacity corresponding to min. 55% of the engine power. In case of malfunction of one of the pumps, it is still possible to operate the engine with 55% engine power, enabling around 80% ship speed.

Fuel oil pressure booster and fuel oil high pressure pipes

The engine is provided with one hydraulically activated fuel oil pressure booster for each cylinder.

Fuel injection is activated by a proportional valve, which is electronically controlled by the Cylinder Control Unit (CCU).

The fuel oil high‘pressure pipes are double-walled and insulated but not heated.

Further information is given in Section 7.01.

Fuel valves and starting air valve

Each cylinder cover is equipped with two fuel valves, starting valve, and indicator cock.

The opening of the fuel valves is controlled by the high pressure fuel oil created by the fuel oil pressure booster, and the valves are closed by a spring.

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An automatic vent slide allows circulation of fuel oil through the valve and high pressure pipes when the engine is stopped. The vent slide also prevents the compression chamber from being filled up with fuel oil in the event that the valve spindle sticks. Oil from the vent slide and other drains is led away in a closed system.

The mechanically driven starting air distributor is the same as the one used on the MC-C engines.

The starting air system is described in detail in Section 13.01.

Engine control system

The ME-B Engine Control System (ECS) controls the hydraulic fuel booster system, the fuel injection, governor function and cylinder lubrication.

The ECS consists of a number of computer-based control units, operating panels and auxiliary equipment located in the engine room and the engine control room.

The ME-B Engine Control System is described in Chapter 16.

Exhaust valve

The exhaust valve consists of the valve housing and the valve spindle. The valve housing is made of cast iron and is arranged for water cooling. The housing is provided with a water cooled bottom piece of steel with a flame hardened seat of the Wide-seat design.

The exhaust valve spindle is a DuraSpindle, a spindle made of Nimonic is available as an option. The housing is provided with a spindle guide in any case.

The exhaust valve is tightened to the cylinder cover with studs and nuts. It is opened hydraulically and closed by means of air pressure. The hydraulic system consists of a piston actuator placed on the roller guide housing, a high-pressure pipe, and a working cylinder on the exhaust valve.

The piston actuator is activated by a cam on the camshaft, a built-in timing piston and a control valve enables control of the closing time of the exhaust valve.

In operation, the valve spindle slowly rotates, driven by the exhaust gas acting on small vanes fixed to the spindle.

Sealing of the exhaust valve spindle guide is provided by means of Controlled Oil Level (COL), an oil bath in the bottom of the air cylinder, above the sealing ring. This oil bath lubricates the exhaust valve spindle guide and sealing ring as well.

Reversing

On reversible engines (with Fixed Pitch Propellers mainly), reversing of the engine is performed in the engine control system by letting the starting air distributor supply air to the cylinders in order of the desired direction of rotation and by timing the fuel injection accordingly.

The exhaust valve gear is not to be reversed.

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Indicator cock

The engine is fitted with an indicator cock to which the PMI pressure transducer is connected. The PMI system, a pressure analyser system, is described in Section 18.02.

Everllence B&W alpha cylinder lubrication

The electronically controlled Everllence B&W Alpha cylinder lubrication system is applied to the ME-B engines.

The main advantages of the Everllence B&W Alpha cylinder lubrication system, compared with the conventional mechanical lubricator, are:

- Improved injection timing
- Increased dosage flexibility
- Constant injection pressure
- Improved oil distribution in the cylinder liner
- Possibility for prelubrication before starting.

More details about the cylinder lubrication system can be found in Chapter 9.

Manoeuvring System

The engine is provided with a pneumatic/electric manoeuvring system. The system transmits orders from the engine control system to the engine.

The manoeuvring system makes it possible to start, stop, reverse the engine and control the engine speed.

The engine is provided with an engine side console and instrument panel.

Gallery arrangement

The engine is provided with gallery brackets, stanchions, railings and platforms (exclusive of ladders). The brackets are placed at such a height as to provide the best possible overhauling and inspection conditions.

Some main pipes of the engine are suspended from the gallery brackets, and the topmost gallery platform on the manoeuvring side is provided with overhauling holes for the pistons.

The engine is prepared for top bracings on the exhaust side, or on the manoeuvring side.

Piping arrangement

The engine is delivered with piping arrangements for:

- Fuel oil
- Heating of fuel oil pipes
- Lubricating oil, piston cooling oil and hydraulic oil pipes
- Cylinder lubricating oil
- Cooling water to scavenge air cooler
- Jacket and turbocharger cooling water
- Cleaning of turbocharger

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- Fire extinguishing in scavenge air space
- Starting air
- Control air
- Oil mist detector (required only for Visatron VN 215/93, make Schaller Automation)
- Various drain pipes.

All piping arrangements are made of steel piping, except the control air and steam heating of fuel pipes, which are made of copper.

The pipes are provided with sockets for local instruments, alarm and safety equipment and, furthermore, with a number of sockets for supplementary signal equipment. Chapter 18 deals with the instrumentation.

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