ME Engine description

General

Engines built by licensees of Everllence are in accordance with our drawings and standards. In certain cases, local standards may be applied but all spare parts are interchangeable with parts designed by Everllence.

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

Bedplate and main bearing

The bedplate consists of high welded longitudinal girders and welded cross girders with cast steel bearing supports. Long elastic holding-down bolts and hydraulic tightening tools are used to fit the bedplate to the engine seating in the ship. The bedplate is made with the thrust bearing in the aft end.

For engines mounted on epoxy chocks, the bedplate is made without taper.

An oil pan made of steel plate is welded to the bedplate. The oil pan, collects return oil from the forced lubricating and cooling oil system. Oil outlets from the oil pan are vertical as standard and provided with gratings.

The main bearings consist of thin-walled steel shells lined with white metal. The main bearing bottom shell can be rotated out and in with special tools and hydraulic tools for lifting the crankshaft. A bearing cap keeps the shells in position.

Frame box

The frame box is welded. On the exhaust side of the frame box, a relief valve is mounted for each cylinder. On the manoeuvring side, each cylinder has a large hinged door. Crosshead guides are welded onto the frame box. The frame box is bolted to the bedplate. Stay bolts tighten together bedplate, frame box, and cylinder frame.

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 has access covers for cleaning the scavenge air space, if required, and for inspection of scavenge ports and piston rings from the manoeuvring side. The cylinder frame and cylinder liner forms the scavenge air space.

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 placed on the cylinder frame. The bottom of the cylinder frame contains the piston rod stuffing box with sealing rings for scavenge air, and oil scraper rings preventing crankcase oil from entering the scavenge air space.

Scavenge air space and piston rod stuffing box drains are located in 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.

On engines type 95-80, the basic design includes cylinder liners prepared for installation of temperature sensors. On all other engines, this type of liner is available as an option.

Cylinder cover

The cylinder cover of forged steel is made in one piece with bores for cooling water. It has a central bore for the exhaust valve, bores for 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. Depending on the number of cylinders, the crankshaft may be supplied in two parts.

At the aft end, the crankshaft is provided with:

- a collar for the thrust bearing
- a flange for fitting the gear wheel for the step-up gear to the hydraulic power supply unit
- a flange for the turning wheel and for the coupling bolts to an intermediate shaft.

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

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 thrust collar, segments, and bedplate to end chocks and engine seating, and to the ship's hull.

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

Engines with nine cylinders or more are specified with a 360-degree type thrust bearing, while a 240-degree type is used for all other engines. The flexible thrust cam design of Everllence is used for the thrust collar on a range of engine types.

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

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Step-up gear

For a mechanically engine-driven hydraulic power supply, the crankshaft drives the main hydraulic oil pumps via a step-up gear. The main engine lubricating oil system lubricates the step-up gear.

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 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 basic design includes a control device for the turning gear, consisting of starter and manual control box.

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 crank journal, and the housing is fixed to the main bearing support.

The vibration damper has a mechanical guide to enable a functional check, an optionally electronic vibration monitor can be supplied.

Engines Mk. 9 and higher require an axial vibration monitor, which indicates condition checks of the axial vibration damper, and terminals for alarm and slowdown.

Tuning wheel / torsional vibration damper

Depending on the final torsional vibration calculations, it may be necessary to order a tuning wheel or a torsional vibration damper, separately.

Connecting rod

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

The crosshead and crank pin bearing caps are secured to the connecting rod with studs and nuts tightened with 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 crank pin bearing is provided with thin-walled steel shells, lined with bearing metal. Lubricating oil is supplied through ducts in the crosshead and connecting rod.

Piston

The piston consists of a piston crown and a piston skirt. The piston crown is made of heat-resistant steel. A piston cleaning ring located in the very top of the cylinder liner scrapes off excessive ash and carbon formations on the piston topland.

The piston has three or four ring grooves which are hard-chrome plated on both the upper and lower surfaces of the grooves. Three or four piston rings are fitted depending on the engine type.

The uppermost piston ring is always a controlled pressure relief (CPR) ring type, whereas the other two or three piston rings are either of the CPR type, or have an oblique cut. Depending on the engine type, the uppermost piston ring is higher than the others. All rings are alu-coated on the outer surface for running-in.

The piston skirt is made of cast iron with a bronze band or molybdenum coating.

Piston rod

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

Crosshead

A crosshead of forged steel is provided with cast steel guide shoes with white metal on the running surface. The guide shoe is of the low-friction type, and the crosshead bearings are 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 turbocharger draws air 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. The scavenge air receiver has a D-shape design.

Scavenge air cooler

Each turbocharger has a scavenge air cooler of the mono-block type.

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

The scavenge air cooler is designed to keep the temperature difference between the scavenge air and the water inlet at about 12°C, at specified MCR.

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.

To obtain a safe start, the auxiliary blowers start consecutively before the engine is started to ensure sufficient scavenge air pressure.

Find more information 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 insulated and covered by galvanised steel plating.

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

Reversing

The engine is reversed electronically by the engine control system which changes the timing of fuel injection, exhaust valve activation, and starting air valves.

2nd order moment compensators

In general, 2^{nd} order moment compensators are relevant only for 5- and 6-cylinder engines of 50 and 45 bore sizes. When needed, an external electrically driven moment compensator, type RotComp or similar, can be installed in the steering room.

Section 17.02 describes 2^{nd} order moment compensators as well as the basic design and options.

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The hydraulic power supply

The hydraulic power supply (HPS) filters and pressurises the lube oil for the hydraulic system. The HPS consists of either mechanically driven (by the engine) main pumps with electrically driven start-up pumps or electrically driven combined main and start-up pumps. The hydraulic pressure is 300 bar.

The engine driven HPS is mounted aft on the engine, for engines with the chain drive placed aft (8 cylinders or less). For engines with the chain drive located in the middle (9 cylinders or more), the HPS is placed in the middle. Usually, the electrically driven HPS is mounted aft on the engine.

Hydraulic cylinder unit

The hydraulic cylinder unit (HCU), one per cylinder, consists of a distributor block mounted on a base plate. The distributor block has one or more accumulators to ensure the necessary peak flow of hydraulic oil during the electronically controlled fuel injection.

The distributor block serves as mechanical support for the hydraulically activated fuel pressure booster and the hydraulically activated exhaust valve actuator.

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 multi-way valve (ELFI or FIVA), which is electronically controlled by the Cylinder Control Unit (CCU) of the engine control system.

The fuel oil high-pressure pipes are of the double-wall type with built-in conical support. The pipes are insulated but not heated. A ‘fuel oil leakage’ system for each cylinder detects fuel oil leakages and immediately stops the injection on the actual cylinder.

Further information is given in Section 7.01.

Fuel valves and Starting Valves

The cylinder cover is equipped with two or three fuel valves, starting air 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.

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.

Supply of starting air is provided by one solenoid valve per cylinder, controlled by the CCUs of the engine control system.

The starting valve is opened by control air, timed by the engine control system, and is closed by a spring.

Slow turning before starting is a program incorporated in the basic engine control system.

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

Exhaust valve

The exhaust valve consists of the valve housing with a spindle guide, 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 made of Alloy 760.

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The exhaust valve is tightened to the cylinder cover with studs and nuts. The exhaust valve is opened hydraulically by the electronic valve activation system and closed by an air spring.

The exhaust valve is of the low-force design. Operation of the exhaust valve is controlled by a multi-way valve (ELVA or FIVA). In operation, the valve spindle rotates slowly, driven by the exhaust gas acting on a vane wheel fixed to the spindle.

Sealing of the exhaust valve spindle guide is obtained with an oil bath, or controlled oil level (COL), in the bottom of the air cylinder above the sealing ring. This oil bath lubricates the exhaust valve spindle guide and sealing ring.

Everllence B&W alpha cylinder lubrication

The electronically controlled Everllence B&W Alpha cylinder lubrication system is applied to the ME engines, and controlled by the ME ECS.

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.

Chapter 9 details information about the cylinder lubrication system.

Gallery arrangement

The engine is provided with gallery brackets, stanchions, railings, and platforms (exclusive of ladders). The positions of the brackets are carefully chosen to provide the best possible overhauling and inspection conditions.

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

The engine is prepared for installation of 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
- Lubricating oil, piston cooling oil, hydraulic oil
- Cylinder lubricating oil
- Cooling water to scavenge air cooler
- Jacket and turbocharger cooling water
- Cleaning of turbocharger
- Fire extinguishing in scavenge air space
- Starting air
- Control air
- 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.