ME-GI 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 consists of high, welded, longitudinal girders and welded cross girders with cast steel bearing supports.

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, which is made of steel plate and is welded to the bedplate, collects the return oil from the forced lubricating and cooling oil system. The 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 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 of welded design. On the exhaust side, it is provided with relief valves for each cylinder while, on the manoeuvring side, it is provided with a large hinged door for each cylinder. The crosshead guides are welded on to the frame box.

The frame box is bolted to the bedplate. The bedplate, frame box and cylinder frame are tightened together by stay bolts.

Cylinder frame and stuffing box

The cylinder frame is cast and provided with access covers for cleaning the scavenge air space, if required, and for inspection of scavenge ports and piston rings from the manoeuvring side. Together with the cylinder liner it 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 located on the cylinder frame. In 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 entering 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.

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Cylinder liner

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

Cylinder liners prepared for installation of temperature sensors is basic execution on engines type 90 while an option on all other engines.

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, gas valves, a starting valve and an indicator cock.

The side of the cylinder cover facing the hydraulic cylinder unit (HCU) block has a face for mounting a special valve block, the Gas Control Block, see later description.

In addition, the cylinder cover is provided with one set of bores for supplying gas from the gas control block to each gas injection valve. The bore for PMI Auto-tuning is the same as the bore for the indicator cock.

Crankshaft

The crankshaft is of the semi-built type, made with forged or cast steel throws. For engines with nine cylinders or more, the crankshaft is 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 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.

Engines type 60 and larger with 9 cylinders or more will be specified with the 360º degree type thrust bearing, while the 240º degree type is used in all other engines. Everllence flexible thrust cam design is used for the thrust collar on a range of engine types.

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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.

Step-up gear

If a mechanically driven (by the engine) hydraulic power supply is installed, the main hydraulic oil pumps are driven from the crankshaft via a step-up gear. The step-up gear is lubricated from the main engine system.

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 crank 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 5- and 6-cylinder engines.

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. 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 of the CPR type (Controlled Pressure Relief), whereas the other two or three piston rings are 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 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. The scavenge air receiver on engines type 65 is of the Dshape design..

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.

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

The engines can be fitted with either Everllence, Accelleron or MHI turbochargers.

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

Reversing

Reversing of the engine is performed electronically and controlled by the engine control system, by changing the timing of the fuel injection, the exhaust valve activation and the starting valves.

2nd order moment compensators

The 2nd order moment compensators are in general relevant only for 5 or 6-cylinder engines, and can be mounted either on the aft end or on both fore and aft end on engines type 70-60.

The aft-end compensator consists of balance weights driven by chain. The fore-end compensator consists of balance weights driven from the fore end of the crankshaft.

On engines type 50, 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.

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The hydraulic power supply

The Hydraulic Power Supply (HPS) filters and pressurises the lube oil for use in 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 approximately 300 bar.

The mechanically driven HPS is engine driven and mounted aft for engines with chain drive aft, and at the middle for engines with chain drive located in the middle. An electrically driven HPS is usually mounted aft on the engine.

A combined HPS, mechanically driven with electrically driven start-up/back-up pumps with backup capacity is available as an option for engines type 70-60 while basic execution for type 50.

Hydraulic cylinder unit

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

The distributor block serves as a 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 (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 doublewall type with built-in conical support. The pipes are insulated but not heated.

Further information is given in Section 7.01.

Gas pipes

A chain pipe system is fitted for high-pressure gas distribution to each adapter block. The chain pipes are connected to the gas control block via the adapter block.

Gas pipes are designed with double walls, with the outer shielding pipe designed so as to prevent gas outflow to the machinery spaces in the event of leaking or rupture of the inner gas pipe.

The intervening gas pipe space, including also the space around valves, flanges, etc., is vented by separate mechanical ventilation with a capacity of 30 air changes per hour. Any gas leakage will be led to the ventilated part of the double-wall piping system and will be detected by hydrocarbon (HC) sensors.

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The pressure in the intervening space is kept below that of the engine room. The extractor fan motor is placed outside the duct and the machinery space. The ventilation inlet air must be taken from a gas safe area and exhausted to a safe place.

The gas pipes on the engine are designed for and pressure tested at 50% higher pressure than the normal working pressure, and are supported so as to avoid mechanical vibrations. The gas pipes should furthermore be protected against drops of heavy items.

The chain piping to the individual cylinders are flexible enough to cope with the mechanical stress from the thermal expansion of the engine from cold to hot condition.

The gas pipe system is designed so as to avoid excessive gas pressure fluctuations during operation.

The gas pipes are to be connected to an inert gas purging system.

Gas control block

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The gas control block consists of a square steel block, bolted to the HCU side of the cylinder cover.

The gas control block incorporates a large volume accumulator and is provided with a window/shutdown valve, a purge valve and a blow-off valve. All high-pressure gas sealings lead into spaces that are connected to the double-wall pipe system, for leakage detection..

Minute volumes around the gas injection valves in the cylinder cover are kept under vacuum from the venting air in the double-wall gas pipes.

Internal bores connect the hydraulic oil, sealing oil and the gas to the various valves. A non-return valve is positioned at the gas inlet to the gas accumulator, in order to ensure that gas cannot flow backwards in the system.

ELGI and ELWI valves and control oil supply are also incorporated in the gas control block.

The gas pressure in the channel between the gas injection valve and the window valve is measured. The pressure measuring is used to monitor the function of and to detect a leaking window valve, gas-injection valve or blow-off valve.

Any larger pressure increase would indicate a severe leakage in the window/ shut down valve and a pressure decrease would indicate a severe leakage in the gas injection valve seats or in the blow-off valve. The safety system will detect this and shut down the gas injection.

From the accumulator, the gas passes through a bore in the gas control block to the window valve, which in the gas mode is opening and closing in each cycle by hydraulic oil. From the window/ shut-down valve, the gas is led to the gas injection valve via bores in the gas control block and in the cylinder cover. A blow-off valve placed on the gas control block is designed to empty the gas bores during gas standby or gas stop.

A purge valve, also placed on the gas control block, is designed to empty the accumulator when the engine is no longer to operate in the gas mode.

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Both hydraulically actuated blow-off and purge valves are also utilised during inert gas purging, all controlled by the gas injection engine control system (ME-GI-ECS).

Fuel valves, gas valves and starting air valve

The cylinder cover is equipped with two or three fuel valves, two or three gas valves, a starting air valve and an 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.

The opening of the gas valves is controlled by the ELGI valve, which operates on control oil taken from the system oil.

An automatic vent slide allows circulation of fuel oil through the valve and the 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 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 (Nimonic on engines type 65 and 50, however) and the housing provided with a spindle guide.

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 is closed by means of air pressure.

The exhaust valve is of the low-force design and the operation of the exhaust valve controlled by a multi-way valve (ELVA or FIVA).

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.

Indicator cock

The engine has an indicator cock for connecting the PMI pressure transducer.

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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 engine control system.

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.

The ME/Alpha Lubricator is replaced by the Alpha Lubricator Mk. 2 on some engines.

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

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 arrangements

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
- 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.

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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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