

Engine Room Simulator

ERS-L11 MAN B&W-5L90MC–VLCC Version MC90-IV

Machinery and Operation

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B	MP-1514	All	Updated to latest version. Changed pictures.
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D	MP-1570		Text and pictures updated according to latest version.

PREFACE

The Operators Manual contains only operator relevant information.

The purpose of Operators Manual is to provide detailed information of the vessel and the machinery modelled and on the operation of the machinery and systems.

The Operators Manual is divided into 4 parts.

Part 1 - Vessel and Machinery - Main particulars

The purpose of this part is to introduce the vessel type and main data, the configuration of the propulsion plant and of the electrical plant. Also an overview of the available service systems is included in the part.

Part 2 - Automation and Control

The purpose of Part 2 is to describe the functions and the features of the automation and the remote control systems on board the vessel.

Part 3 - Machinery and Operation

The purpose of Part 3 is to provide a comprehensive manual describing system details and giving guidelines to operating procedures of each system.

Each system includes a system drawing and a description divided into 4 parts:

- **General** - describing the purpose of the system and also including system features and international regulations when relevant.
- **Description** – describing the system details.
- **Operation procedures** – giving a detailed guideline on the operation of each system. Importance is attached to the use of appropriate and safe procedures.
- **Model particulars** – focusing on special model features or limitations to be aware of.

Part 4 – Appendixes

Appendix A Trip Codes - an overview of default trip codes of the machinery.

Appendix B Alarm list – contains all alarm tags

Appendix C Malfunction list – contains all variables.

Appendix D Variable list - contains all malfunctions that can be introduced

Appendix E Controllers and actuators – introduces the features of PID controllers and modulating valves.

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**ERS-L11 MAN B&W-5L90MC VLCC
Version MC90-IV**

Machinery and Operation

Part 1

Vessel and Machinery

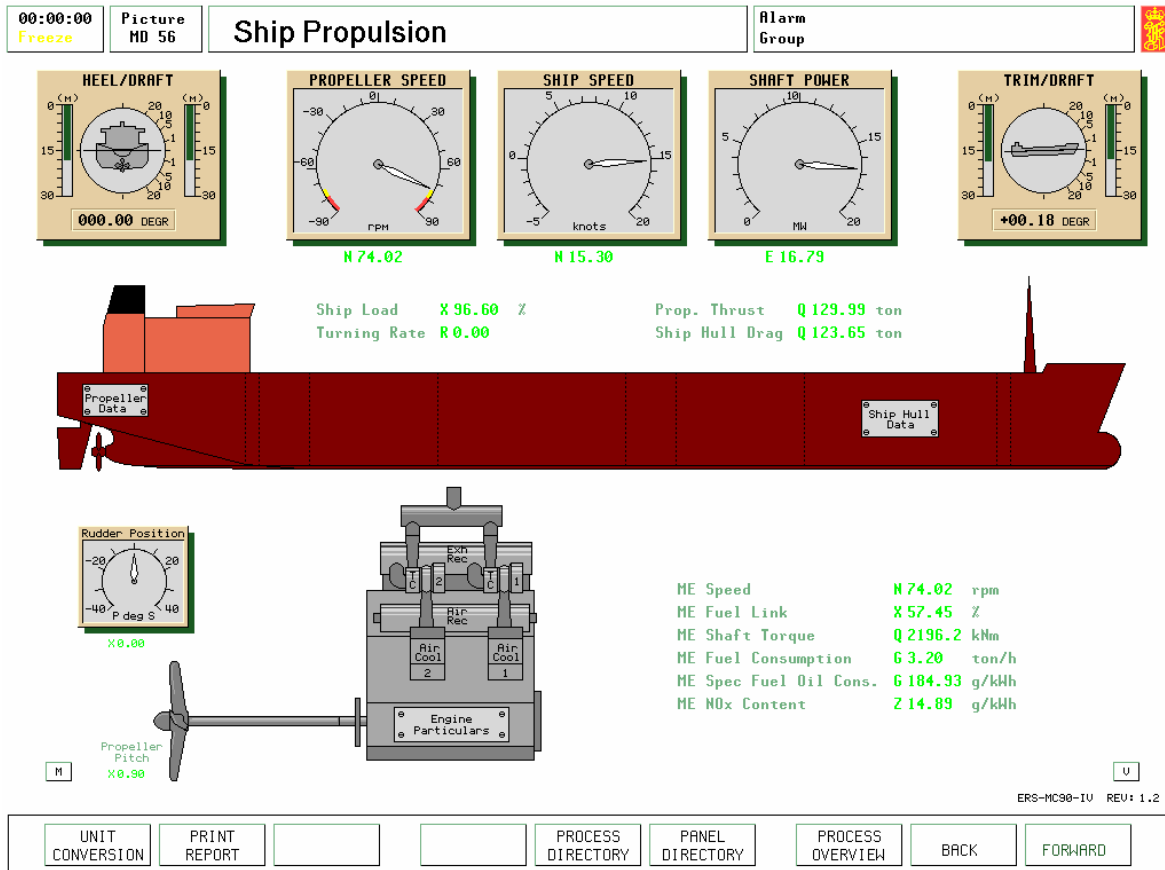
Main Particulars

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1 GENERAL DESCRIPTION

1.1 Main ship data



The ship represents a VLCC with the following main data:

- Length OA 305 m
- Length bp 295 m
- Breadth moulded 47 m
- Depht moulded 30.40 m
- Summer draught 19.07 m
- CB 0.801
- Dead weight 187997 tons
- Speed 14 knots

Main Engine

- Type MAN B&W 5L90MC
- Continuous Service Rating ME 17.4 MW
- Corresponding Engine Speed 74 rpm

**Propeller System**

- The propeller system includes both FPP and CPP, selectable from the Main Engine Control Console (AutoChief)

Electrical power plant

- two 850 kW/440 V/60Hz diesel engine driven synchronous generators
- one 1200 kW/440 V/60Hz synchronous shaft driven generators
- one 850 kW/440 V/60Hz steam turbine driven generator
- one 180 kW/440 V/60Hz emergency generator

Thrusters

1 CPP Bow Thruster 750 kW

Steering Gear

Double acting, rotary vane type, IMO Model

Tanks

The following main tanks are included:

- 2 HFO settling tanks
- 1 HFO service tank
- 1 DO service tank
- 4 Fuel oil bunker tanks
- 1 Spill oil tank
- 1 Sludge tank
- 1 Clean bilge tank
- 1 DO storage tank
- 1 Cyl. Lubrication oil storage tank
- 2 x 1 Ballast wing tank
- 1 Fore peak tank

2 ALARM, MONITORING AND REMOTE CONTROL SYSTEM

The alarm, monitoring and remote control is handled by the following modules:

- The **DataChief** module for general alarm and monitoring of machinery and vessel.
- The **AutoChief** module for remote control and management of the propulsion plant.
- The **PowerChief – Generator Control** module for remote control and management of the generators.
- The **PowerChief – Pump and Compressor Control** module for remote control and management of the pumps and air compressors.

The DataChief consists of one (or more) high-resolution graphic workstation with a dedicated keyboard.

Alarms are announced by an audible signal and the alarm group is indicated in the upper part of the monitor. Alarm log, alarm acknowledgement and general alarm handling is described in a separate section in the document.

The DataChief also act as the operator station. All functions incorporated in a general workstation, such as mimic drawings, trend system, PID Controllers, general numeric indicators, status signal and alarm limits are available.

The AutoChief is handled from a separate AutoChief panel.

The Power Chief – Generator Control and the PowerChief - Pump and Compressor Control modules may be operated from a separate panel (if applied) or directly from the DataChief operator station.



3 PROPULSION PLANT

3.1 Main engine data

The propulsion machinery is based on one MAN B&W 5L90MC, low speed, 5 cylinder configuration, 2-stroke, turbocharged, reversible diesel engine. The main engine is coupled to a propeller shaft with both fixed pitch propeller and controllable pitch propeller (selectable by the instructor). Also a shaft generator is attached to the main engine.

Main engine particulars

- Cyl Bore	900	mm
- Piston Stroke	2900	mm
- Number of Cylinders	5	
- Number of Air Coolers	2	
- Number of Turbo Chargers	2	
- Continuous Service Rating ME	17.4	MW
- Corresponding Engine Speed	74	rpm
- Mean Indicated Pressure	13.0	Bar
- Scavenge Air Pressure	2.1	Bar
- Turbine Speed	8000	rpm
- Number of Prop. Blades	5	
- Propeller Pitch	0.9	P/D
- Specific Fuel Oil Consumption	168	g/kwh

The main engine is equipped with the following auxiliary systems:

- HTFW cooling system including pre-heating system.
- LTFW cooling system
- Fuel oil high pressure system
- Main lubrication oil system
- Cam shaft lubrication oil system
- Turbocharger and scavenging air cooling system.
- Manoeuvring system.
- Selective Catalytic Reduction

The propeller system includes:

- Propeller servo system
- Stern tube lubrication oil system
- Steering gear system

3.2 Main propulsion plant - Operation and control modes

When remote controlled from the engine control room or from the bridge control panel, the AutoChief controls the propulsion plant.

The main engines may be operated in four different modes.

The four modes are:

- Combinator
- Fixed pitch
- Fixed speed
- Economy

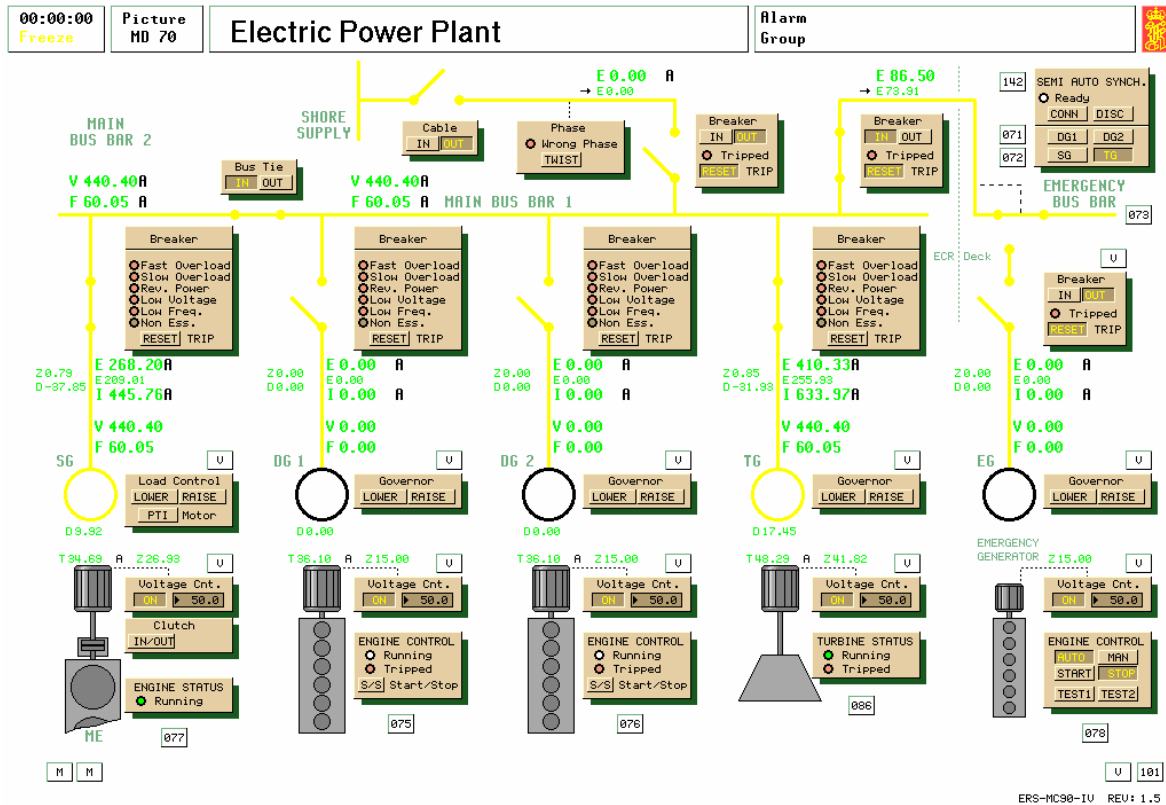
The AutoChief also handles the propulsion plant safety and overload control system including:

- Slow down and shut down functions for the main engine
- Main engine load limitations (scavenge air pressure and torque control)
- Thermal limitations
- Overload control of main engine



4 ELECTRICAL POWER PLANT

4.1 Electrical power supply



The ship's electric power is generated by:

- two 850 kW/440 V/60Hz/1200 rpm diesel engine driven synchronous generators - diesel generator 1 (DG1) and diesel generator 2 (DG2)
- one 1200 kW/440 V/60Hz/converter controlled synchronous shaft generator
- one 850 kW/440 V/60Hz/steam turbine driven synchronous generator
- one 180 kW/440 V/60Hz emergency generator

and distributed via:

- one main switchboard, divided into two main 440V bus bars
- one 220 bus bar
- one emergency bus bar

Bus bar 1 powers all the electrical main consumers and the emergency bus bar.

Bus bar 2 powers the bow thruster and deck machinery.

The 220 V bus bar powers the lightning panels, control consoles and various 220 consumers and is supplied from bus bar 1 via the 220V bus bar circuit breaker and two transformers.

4.2 Main switch board functions

Main switch board functions

The main switchboard functions includes all controls and indicators usually available on real switchboards.

Each of the generator sections contains meters for V, A, kW, kVAr and Hz. A selector switch enables the reading of the separate phases.

Voltage control

The field voltage (magnetisation)-setting device enables voltage control and balancing between active and reactive load when the generators are operating in parallel. AVR settings are available in the pop-up window.

RPM control

The rpm of each generator, can be adjusted from the main switchboard (Electrical Power Plant)

Generator breakers

Automatic disconnection of the generators from the bus bar is activated by the following functions:

- Fast overload of generator
- Slow overload of generator
- Reversed power
- Low voltage
- Low frequency

The breaker also activates non essential consumer trip.



4.3 Electrical power plant - Operation modes

The electric power system is designed for various operation modes dependant on propeller type (FFP or CPP):

I Harbour Mode (Valid for both FFP and CPP)

The diesel generators power both bus bars, which are connected by the tie-line breakers.

II Manoeuvre mode a) CPP

(Thruster in operation)

Bus tie-line breaker is open. The diesel generators power main consumers via bus bar 1. Shaft Generator powers the bow thruster.

Note! In CPP mode shaft generator and diesel generator may operate in parallel (bus tie-line breaker closed).

Manoeuvre mode b) FFP

(Thruster in operation)

Bus tie-line breaker is closed. The diesel generators and the shaft generator operates in parallel.

III Sea passage (Valid for both FFP and CPP)

(Diesel generators disconnected)

Bus tie-line breaker closed. Diesel generators are stopped and stand by.

4.4 Emergency generator

The emergency generator is arranged for automatic start and connection to the emergency switchboard in the event of failure of normal supply from bus bar 1.

In the event of low voltage at bus bar 1 the following sequence will take place, provided that the emergency generator is in AUTO:

1. The emergency generator is started
2. The emergency tie-line breaker is opened
3. The emergency generator is connected to the emergency bus bar.

and when the voltage at bus bar 1 is re-established the sequence is

1. The emergency generator circuit breaker is disconnected
2. The emergency tie-line breaker is closed
3. The emergency generator stops after a few minutes of idling.



The emergency switchboard is equipped with two **TEST** buttons; TEST 1 and TEST2. If the TEST1 button is activated a zero-voltage at the bus bar is simulated. The emergency generator will start, the emergency generator breaker will close provided that the emergency generator is in AUTO. A lamp indicates when the test function is active.

When pressing the TEST 2 button the bus tie breaker will open and a “real black-out” will be detected. The emergency generator will start and connect and feed the emergency bus bar.

NOTE

It is not possible to run the emergency generator in parallel with the main generators.

4.5 Shore power

Bus bar 1 is supplied from shore connection via the shore cable and the shore connection circuit breaker. The maximum electric load obtained via the shore connection is 280 kW. At cable connection, the electric phase will be chosen at random. A rotating light-wheel indicates the phase sequence. Clockwise rotation is correct. Pressing the “WRONG PHASE” button simulates a corrective phase change and the shore connection can be set.




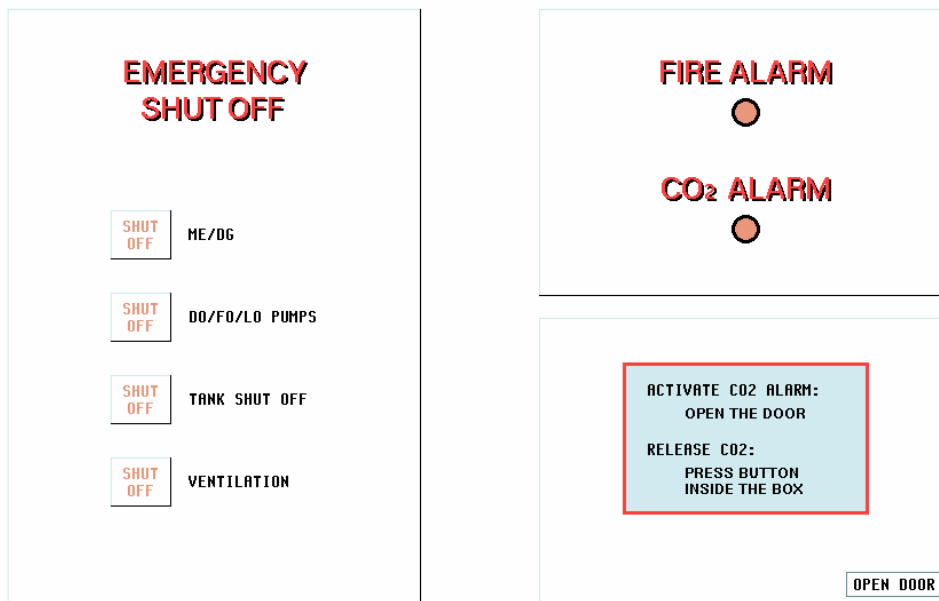
5 SERVICE SYSTEMS

All service systems can be operated from the operator station or locally from the engine room. The following machinery and systems are included:

- Sea water system
- Fresh water system
- Fuel oil transfer system
- Fuel oil settling tanks
- Fuel oil supply system
- Fuel oil service tanks
- Fuel oil separators system
- Diesel oil separator system
- Lubrication oil purifier system
- Start air compressor system
- Service air compressor system
- Air ventilation system
- Fresh water generator
- Bilge system including bilge separator
- Refrigerating system
- Fresh Water Sanitary
- Steam system
- Cargo pump turbines
- Ballast water system
- Inert gas plant

6 FIRE MONITORING AND EXTINGUISHING EQUIPMENT

00:00:00 Freeze	Picture MD 115	Remote Emergency Operating Panel	Alarm Group	
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ERS-MC90-IV REV: 1.0

A fire indication system indicates when:

- Fire in engine room
- Fire deck area

The engine room is protected by a CO₂ system with remote release.

Additionally the vessel is equipped with 2 seawater Fire & General Service pumps and a emergency fire pump. Fire hydrant is opened from variable page (water canon).

