UNITEST

MARINE TRAINING SOFTWARE, SIMULATORS AND DIESEL ENGINE TESTERS

UNITEST

DESKTOP TYPE

MS ENGINE ROOM SIMULATOR

User's Manual

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1. Introduction

1.1 General description and application

The UNITEST MS Engine Room Simulator has been based on typical solutions, being presently used in medium-sized engine rooms (two four-stroke type main engines with reduction gear and CPP - controllable pitch propeller).

This simulator is designated for training students of maritime academies as well as for different types of marine vocational training centres. The simulator has universal features and may be used both for training merchant and navy fleet crew.

The main purpose of the simulator is the practical preparation of the trainee for engine room operation, and more particularly:

- familiarization with the basic engine room installation (compressed air system, fresh and sea water cooling system, lubricating and fuel oil system, gear and CPP hydraulic system);
- acknowledgment with main engines and auxiliary equipment starting procedure;
- propulsion system manoeuvring (main engines – reduction gear – CPP);

The simulator has been equipped with a desktop type realistic console that enables main engines, gear and CPP operation and control. A general view of the console has been presented on Fig. 1.1, 1.2 and 1.3.

Fig. 1.1 Simulator's console with PC monitor view

Fig. 1.2 Simulator's console general view

Fig. 1.3 Simulator's control units view

Two versions of engine room simulator with medium-speed main engines are available:

- full version (console and software)
- software version (without console)

The console control panel in the software version only is presented on Fig. 1.4.

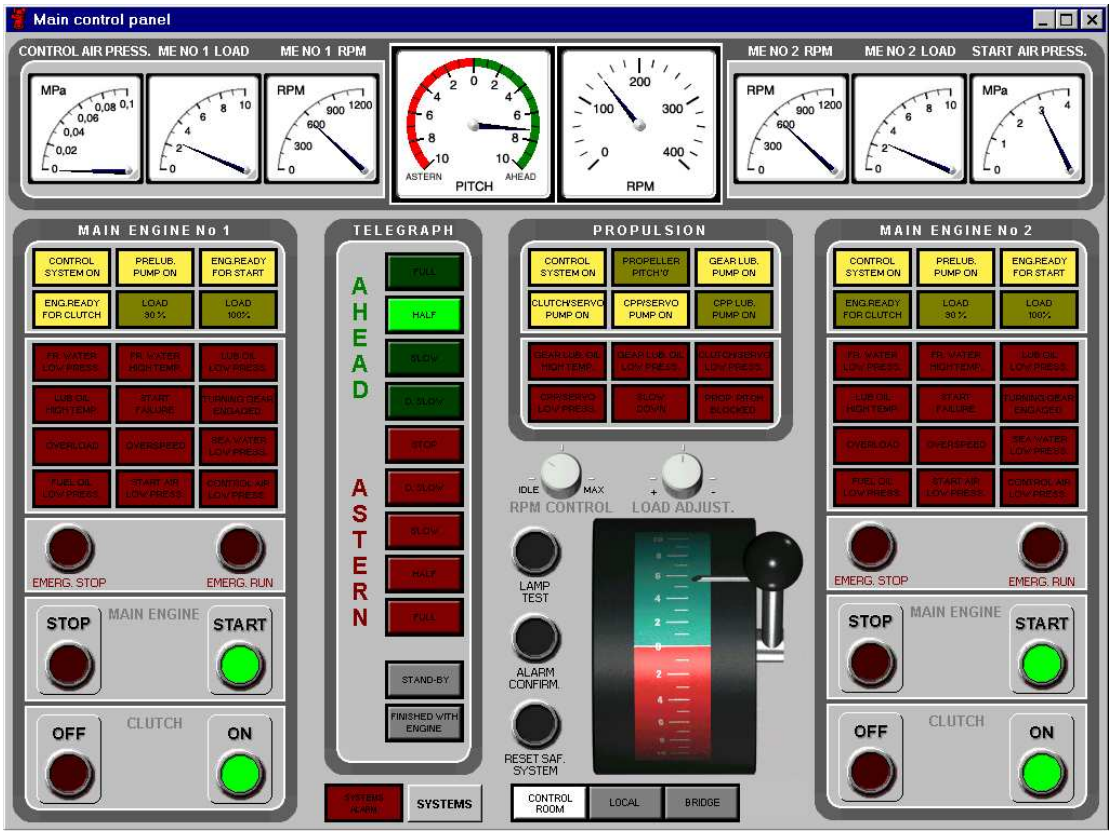


Fig. 1.4 Simulator's console control panel view (software version)

Both version of simulator (full and software) can be run in two modes:

- normal
- supervised

In normal mode all the simulator options are available (setup, checklist, freeze simulator and alarm log).
In supervised mode setup, checklist, freeze simulator and alarm log are not available. It's a special mode for student's competency evaluation.

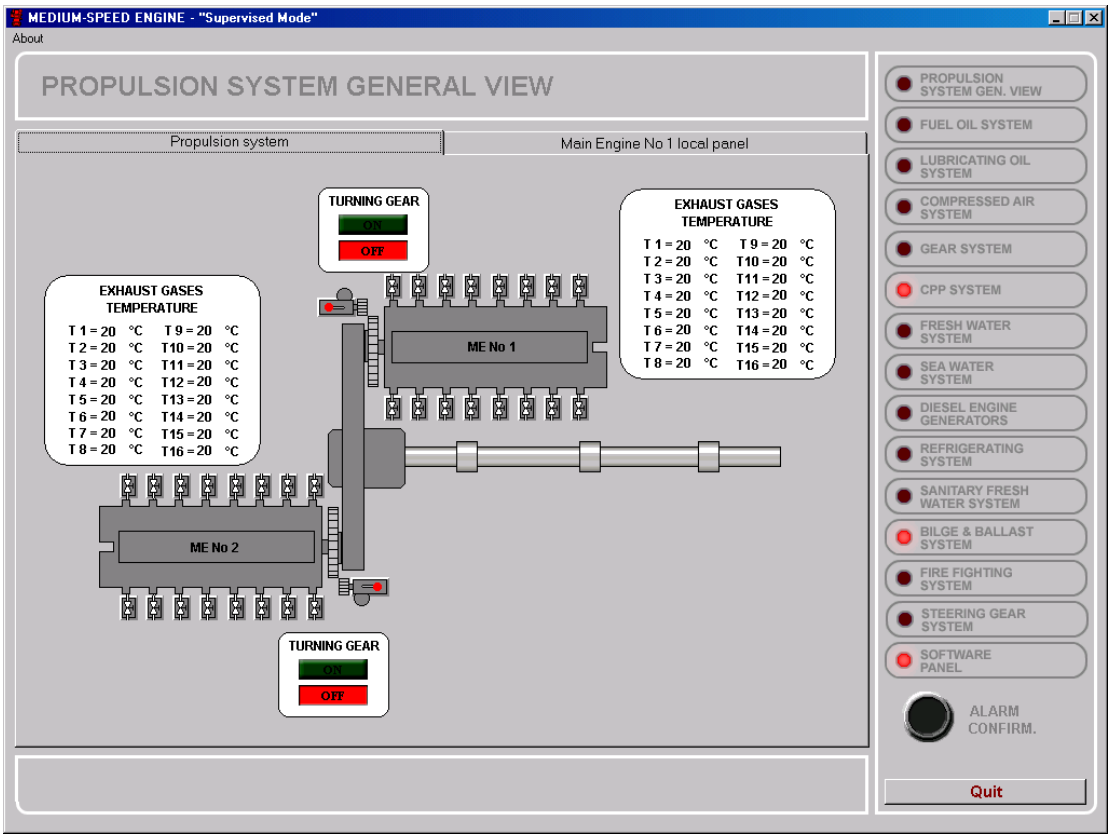


Fig. 1.5 Simulator in Supervised mode

The software allows for the simulation of opening/closing of basic valves and auxiliary equipment operation in engine room installations. The software also generates the main engine room's sound. The installation diagrams with control panels are presented on Fig. 4.1 – 4.45.

The installation of the simulator's software is simple, it is performed by the user and does not require any manufacturer's installation services.

Additionally, the simulator's user also receives software for testing the functioning of the console's electronic system.
The software also enables to set up engine room resources and load or save setups.

The simulator software's language version is English.

Instructor station software allows for:

- system set-up (liquid levels in the tanks and pressure setting)
- freeze simulator
- manoeuvring command

Instructor station is connected by phone with the trainee station.
Software of instructor's station (in multi-station version only) enables also the observation of the following trainee's station indications Fig. 1.6:

- systems alarm
- shaft revolution
- alarm log

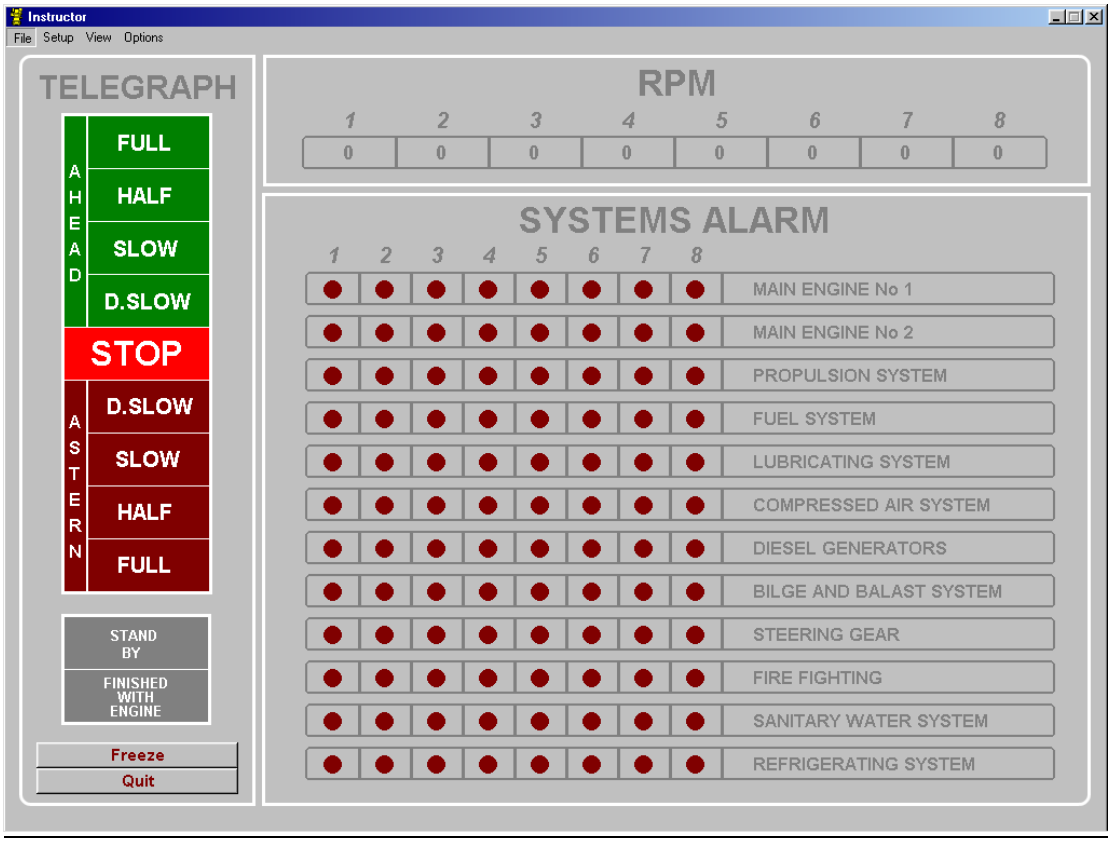


Fig. 1.6 Instructor station software

This simulator has been developed in compliance with:

- STCW Code: Section A-1/12 and Section B-1/12.
- ISM Code: Section 6 and Section 8.

1.2 Desktop type console description:
The console contains:

- main engines and CPP gauges panel;
- telegraph panel;
- main engines control panel;
- propulsion system panel;
- systems' alarm panel;
- phone;
- trackball;
- electronic devices (analogue/digital multi-channel system) with supply unit;
- control and operation software;

Dimensions: length 800 mm; width 750 mm; 220 mm high;
Weight: ca. 25 kg

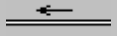
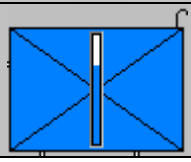
1.3 Hardware requirements:

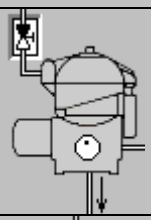
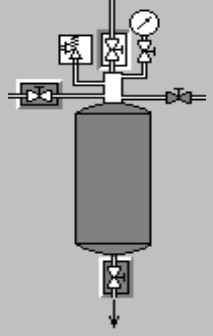
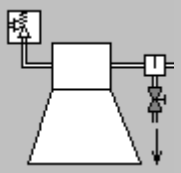
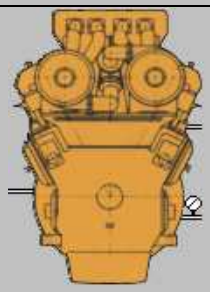
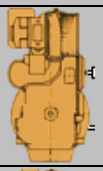
IBM compatible PC – Pentium II 450 MHz, 128 MB RAM, 4,0 GB HDD, Graphic card 16 MB, CD-ROM drive, min. 17 ", multimedia colour monitor, PS/2 mouse input for trackball connection, Windows 98.

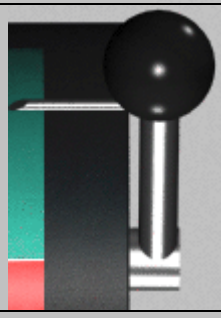
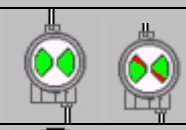
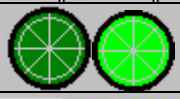
1.4 Abbreviations

ME – Main engine
DG – Diesel generator
EM DG – Emergency diesel generator
LUB OIL – Lubricating oil
PRELUB OIL PUMP – Pre-lubricating oil pump
AUX LUB OIL PUMP – Auxiliary lubricating oil pump
FW – Fresh water
SW – Sea water
CPP – Controllable pitch propeller
AUX PUMP – Auxiliary pump
PRESS – Pressure
TEMP – Temperature
RPM – Revolution per minute
MSB – Main switchboard
ESB – Emergency switch board
STATOR HEAT – Stator heating

1.5 Graphic symbols

	fresh water pump
	sea water pump
	fuel oil pump
	lubricating oil pump
	hand pump
	valve closed
	valve open
	three-way valve
	thermostatic valve
	non-return valve
	valve, straight through
	filters, active control button
	clean, push-button
	pipe (flow direction)
	pressure gauge
	pressure reductor
	mudbox
	tank

	cooler
	centrifuge
	starting air receiver
	compressor
	ME
	DG
	EM DG
	2-position switch
	3-position switch

	push-button
	Potentiometer
	control lever (in software version)
	three-way valve, controlled by active lever
	multi-position control handwheel
	filter pressure drop indicator (green – filter clean, red – filter dirty)
	indication lamp (Off, On)
	indication lamp (Off, On)
	indication lamp (Off, On)
	tank high level indicator (Off, On)

2. Installation

Attention !
Please note that the hardware installation should be completed before the software installation.

2.1 Hardware installation

The hardware installation requires the following steps to be completed:

- The computer has to be switched **OFF.**
- The hardware console has to be plugged into the power socket Fig. 2.1, but power switch at the console should remain in the **OFF** position (the key is in a vertical position).
- The PS/2 socket at the console marked as MOUSE should be connected with the Mouse PS/2 port at the computer. This operation can be omitted if the user prefers to use the computer mouse instead of the trackball at the console.
- The Cannon type 9-pins socket at the console marked as RS232 should be connected with the COM2 serial port at the computer. If COM2 is already used by another peripheral device, any other serial port (COM1, COM3, COM4) can be used instead, however it will be necessary to change certain software settings in order to establish the proper data transmission between the console and the computer . Please remember that only the delivered serial cables (or other serial cables with all pins connected) should be used.
- The power switch at the console can be switched **ON** (turn clockwise to the horizontal position).
- The computer can be switched **ON**.

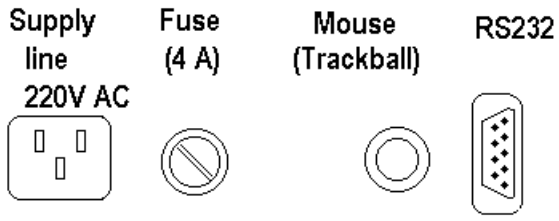


Fig. 2.1 Cables connection on rear panel

Generally, the power switch at the console should be rather switched on before the computer is turned on. The computer should be rather switched off as first and the console as second when the console is stopped being used. It is not necessary to switch on the console, if the user does not intend to use a hardware console but only wants to use the computer.

2.2 Software Installation

1. Insert CD into the CD-ROM drive.
2. Select "Run…" from the "Start" menu.
3. Type "[CD-ROM drive letter]:\setup.exe" (ex. d:\setup.exe).
4. Follow the instructions shown on the screen.
5. After the installation please run "Hardlock installation".
6. Turn off the computer and insert the Hardlock Key

3. Simulator description

3.1 Simulation model

The simulator is based on an engine room composed of two medium-speed diesel ME and three diesel engine generators.

The propulsion system includes two ME, driving through reduction gear the controllable pitch propeller (CPP). Propeller's revolutions and pitch are controlled simultaneously.

The simulator is divided into the following modules:

- ME propulsion
- Fuel system
- Cooling system
- Lubricating system
- Compressed Air system
- Power plant
- Bilge and ballast system
- Steering gear
- Fire fighting system
- Sanitary water system
- Refrigerating system

4. Engine Room Specification

4.1 Main Engine

Diesel engine, four-stroke type with direct injection, non-reversible with two turbo-chargers.

Nominal power	3200 kW
Nominal RPM	1000 rpm
Number of cylinders	16
Piston diameter/stroke	250/300 mm
Piston's cooling and lubrication	lubricating oil
Cylinders' and turbochargers' cooling	fresh water
Turbochargers' air cooling	sea water
ME are equipped with turning gear	
Engines started with compressed air system	

4.2 Diesel generator engine

Diesel engine, four stroke type, with direct injection, non-reversible, with turbo-charger.

Nominal power	550 kW
Nominal RPM	1000 rpm
Number of cylinders	6
Piston diameter/stroke	200/240 mm
Cylinders' cooling	fresh water
Engines started with compressed air system	

4.3 Emergency diesel generator engine

Diesel engine, four stroke type, with direct injection, non-reversible, without turbo-charger.

Nominal power	240 kW
Nominal RPM	1500 rpm
Number of cylinders	8 (V)
Piston diameter/stroke	130/150 mm
Cylinders' cooling	fresh water
Engines started with electrical system	

4.4 Reduction gear

Gear with internal thrust bearing and multi-plate clutch, reduction rate – 1 : 4

4.5 Sea water cooling system

The purpose of this system is to cool:

a. ME fresh water, lubricating oil, turbo charging air, exhaust gases collector;
b. DG fresh water and lubricating oil;
c. gear lubricating oil;
d. CPP lubricating oil;
e. shaft bearings lubricating oil;
f. compressors

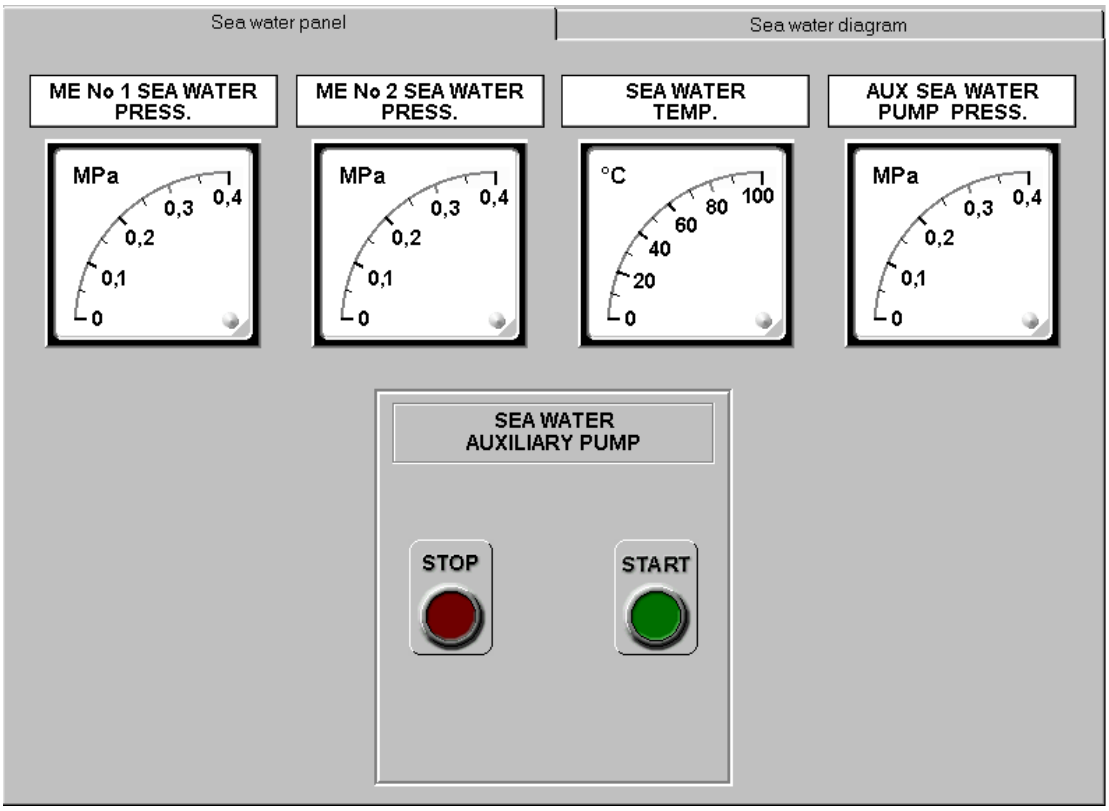


Fig. 4.1 Sea water cooling system control panel

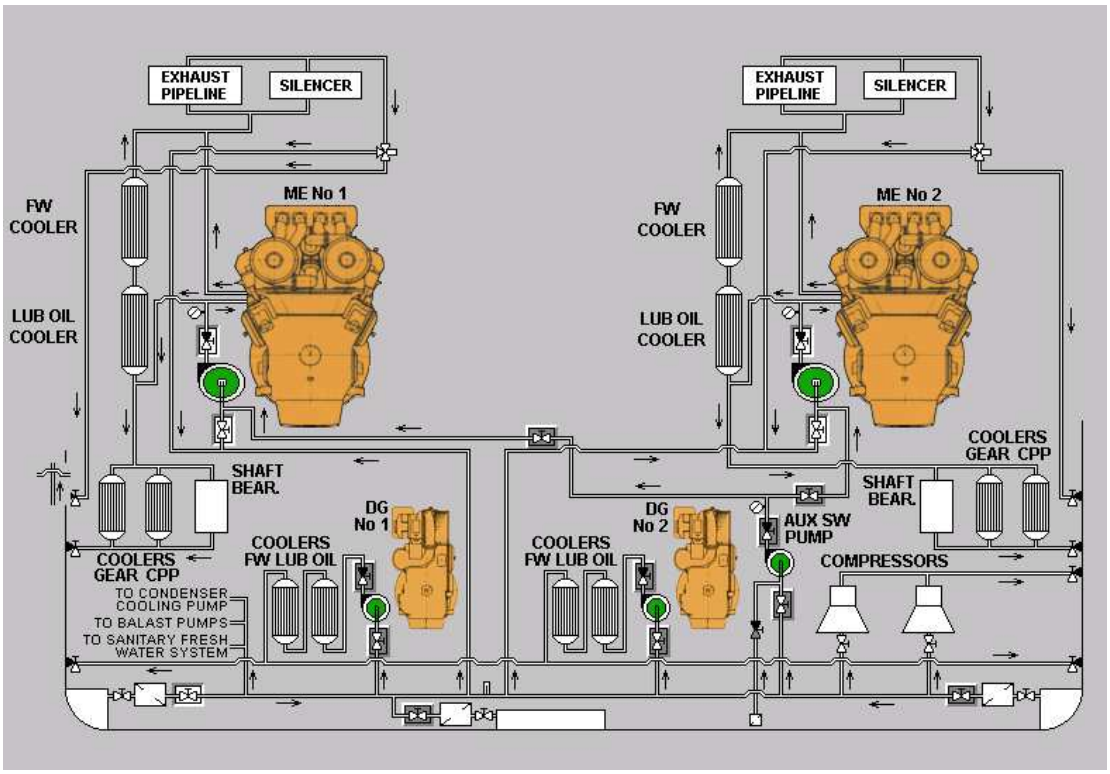


Fig. 4.2 Sea water cooling system diagram

The system consists of the following elements:

a. two ME lubricating oil coolers;
b. two ME fresh water coolers;
c. two gear lubricating oil coolers;
d. two CPP lubricating oil coolers;
e. two DG lubricating oil coolers;
f. two fresh water lubricating oil coolers;
g. two exhaust gases collector's coolers;
h. two ME sea water pumps;
i. two DG sea water pumps;
j. one sea water auxiliary pump.

ME and DG sea water pumps are suspended. Two overboard discharge valves and one kingston (bottom) valve are installed in the system. The valves are linked by a sea water main pipeline.
Air compressors sea water pumps are also of the suspended type. Auxiliary sea water pump serves for ME sea water pump priming.

4.6 Fresh water cooling system

The purpose of the system is to cool:

a. ME cylinders and turbochargers;
b. DG cylinders;
c. EM DG cylinders;

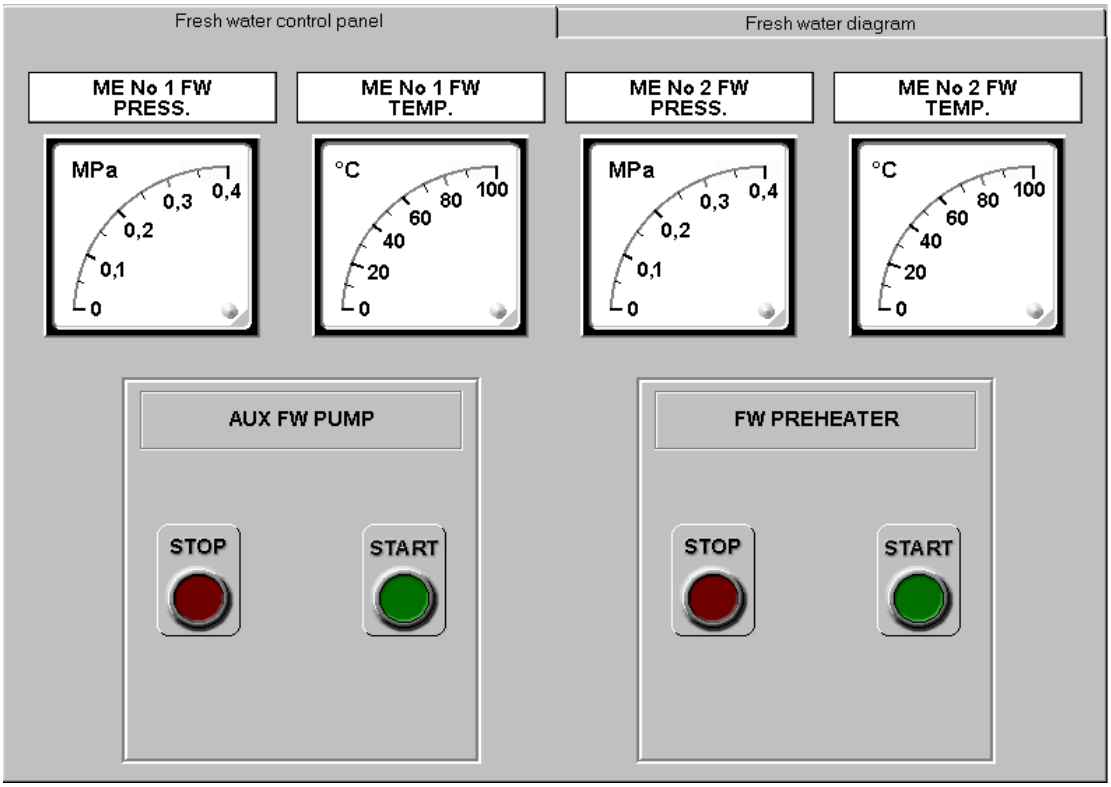


Fig. 4.3 Fresh water cooling system control panel

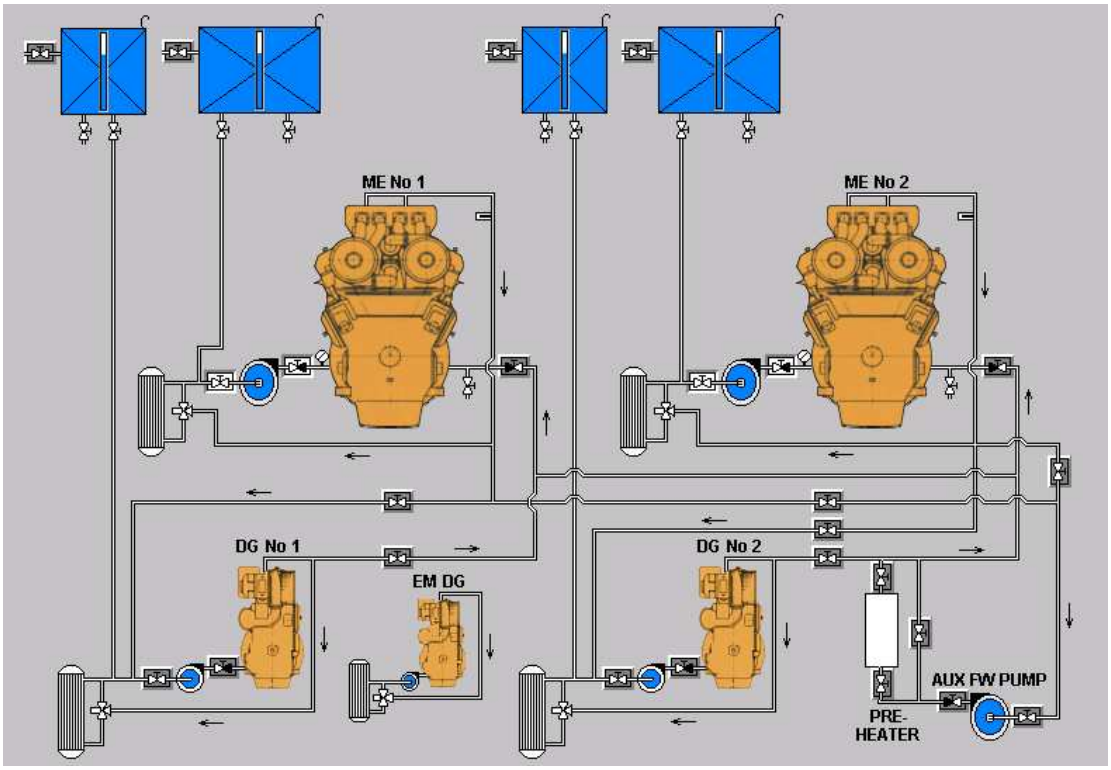


Fig. 4.4 Fresh water cooling system diagram

The system consists of:

a. two ME fresh water coolers;
b. two DG fresh water coolers;
c. two ME gravity tanks;
d. two DG gravity tanks;
e. one EM DG fresh water cooler;
f. two ME fresh water pumps
g. two DG fresh water pumps
h. one emergency fresh water pump

ME and DG contain suspended type fresh water pumps. The fresh water system is separate for each engine.
Each of the engines possesses its own cooler and fresh water gravity tank.
The required temperature on each engine's outlet is kept by a thermostatic valve.
The fresh water circulates within a closed circuit for each of the engines separately.
The filling of the water is effectuated by the gravity tanks.
In order to heat fresh water of the ME, an auxiliary fresh water pump and an electric heater have been installed. There is also a possibility to heat the ME by using fresh water from the DG.

4.7 Fuel oil system

The fuel oil system's purpose is to conduct the fuel from the bottom tanks, through the centrifuge or auxiliary supply pump and the fine (secondary) filter, to the service tank and then to the ME and DG.

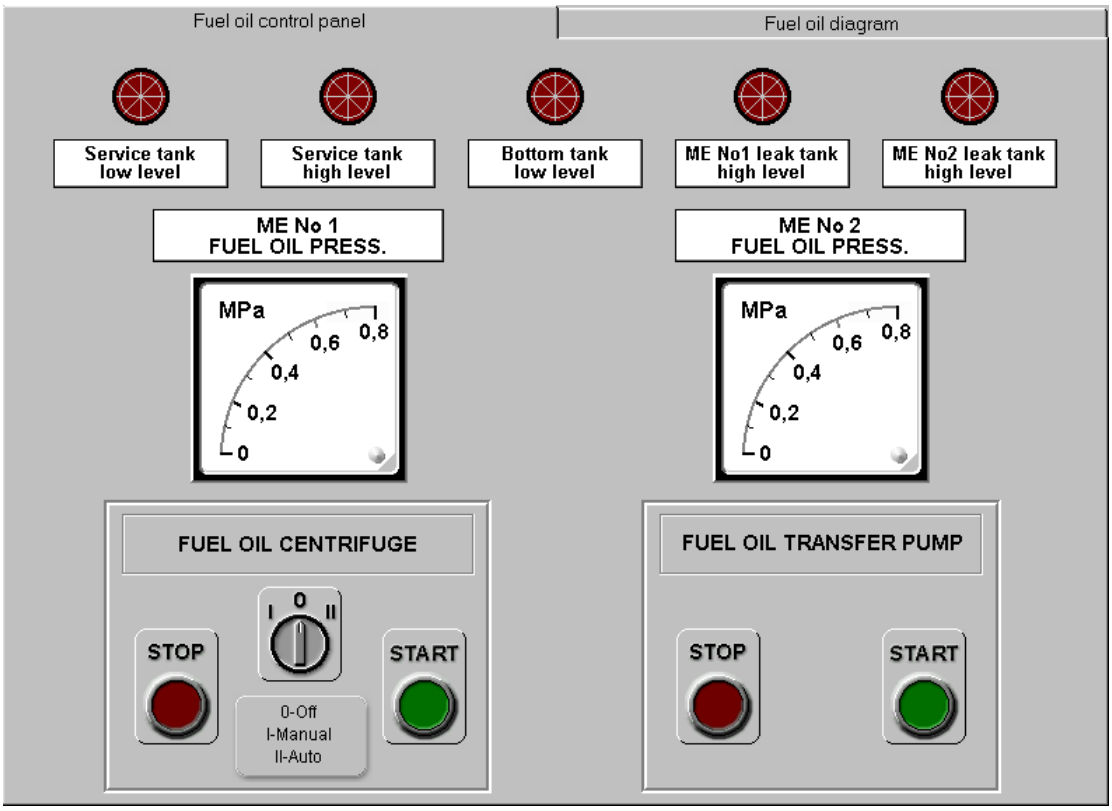


Fig. 4.5 Fuel oil system control panel

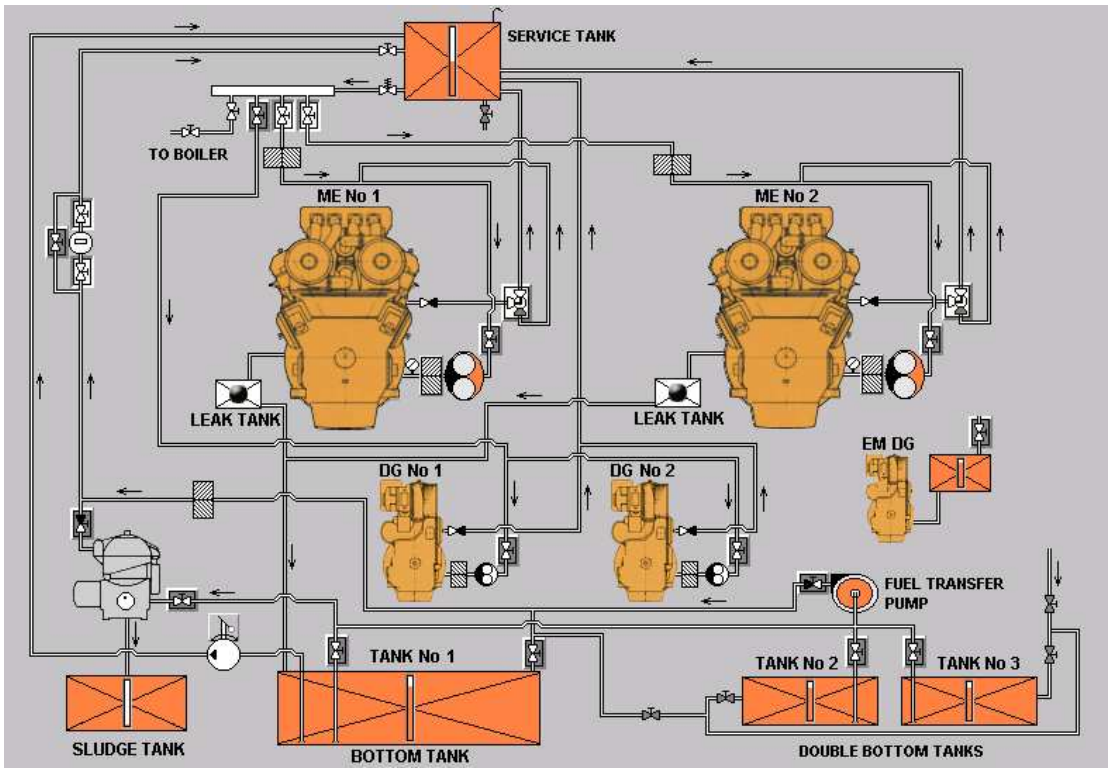


Fig. 4.6 Fuel oil system diagram

The system consists of:

a. one fuel oil service tank;
b. three fuel oil bottom tanks;
c. two fuel oil leak tanks (from ME injection system);
d. one fuel oil centrifuge;
e. one fuel oil transfer pump;
f. one auxiliary (hand) transfer pump;
g. one fine (secondary) filter on the discharge side of the auxiliary supply pump;
h. two secondary filters before the ME fuel oil pumps;
i. one fuel oil EM DG tank;
j. two ME fuel oil pumps;
k. two DG fuel oil pumps.

The ME and DG possess suspended – type fuel oil pumps and secondary filters. A flow meter is installed on the pipe service tank. Fuel oil overflow from the ME and DG is conducted back to the service tank.

The fuel hand pump is available for use when there is no electric power available in the engine room and the fuel oil service tank is empty. This pump button should be pressed many times consecutively, in order to obtain the pump action.

The fuel oil centrifuge can be operated in automated **AUTO** or in manual **MANUAL** mode. When working in the automated mode, the separator will start when the fuel level in the service tank reaches the low limit level and stop when the level reaches the upper limit. The start lamp always lights when the separator is working.

Filters before ME in fuel oil system are of an active type, this means that after clicking on suitable filter, a special dialogue window will appear Fig 4.7.

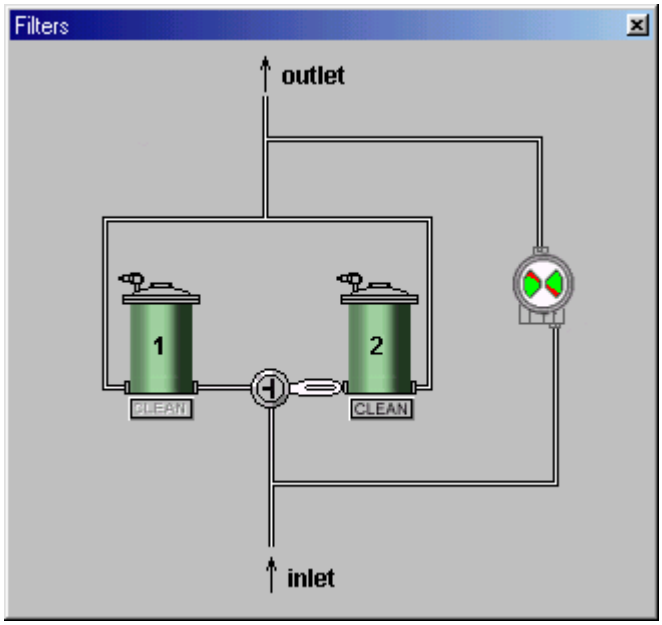


Fig. 4.7 Filter's dialogue window

This window can be used for choosing adequate filter to work and also for cleaning the filter by pressing **clean** push button.

4.8 Lubricating oil system

The lubricating oil system main task is the storage and delivery of lubricating oil for the ME and DG.

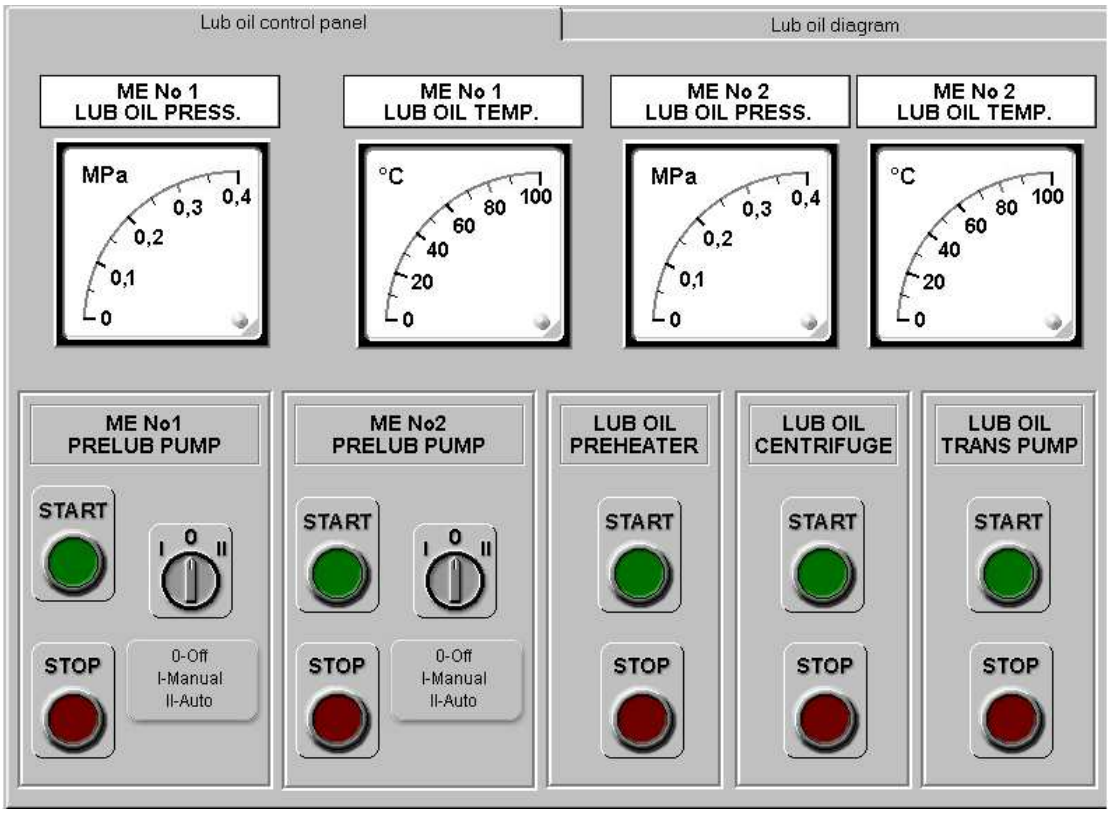


Fig. 4.8 Lubricating oil system control panel

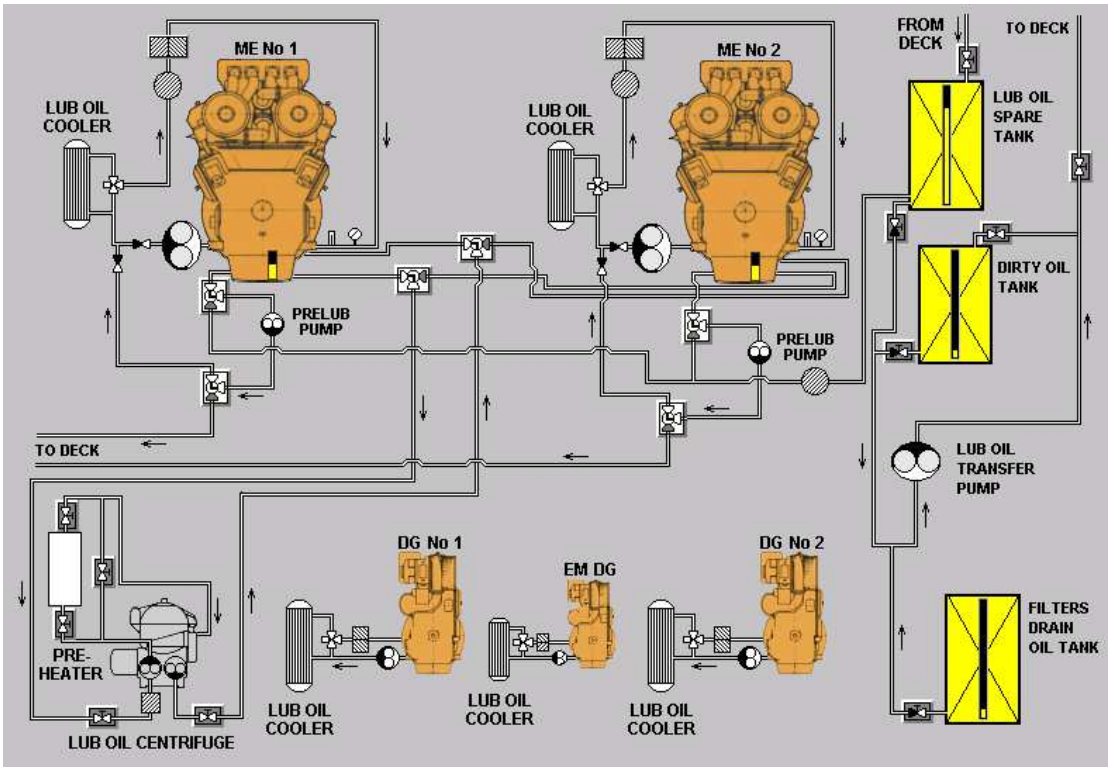


Fig. 4.9 Lubricating oil system diagram

The system consists of:

a. one lubricating oil spare tank;
b. two dirty oil tanks;
c. two ME lubricating oil coolers;
d. two DG lubricating oil coolers;
e. one EM DG lubricating oil cooler;
f. one lubricating oil centrifuge;
g. one lubricating oil pre-heater;
h. two fine (secondary) and magnetic filters before the ME;
i. two fine (secondary) filters before the DG ;
j. one magnetic filter after oil spare tank
k. two ME pre-lubricating pumps
l. one auxiliary supply pump
m. two ME lubricating oil pumps;
n. two DG lubricating oil pumps;

The ME and DG possess suspended – type lubricating oil pumps and secondary filters.
Pre-lubricating pumps are designated also for ME crankshaft casing oil filling and disposal.

Filters before ME in lubricating oil system are of an active type, this means that after clicking on suitable filter, a special dialogue window will appear Fig 4.7.

4.9 Compressed air system

The purpose of compressed air system is the storage and supply of air for:

a. ME starting
b. DG starting
c. control system
d. auxiliary purposes
e. water hydrophore

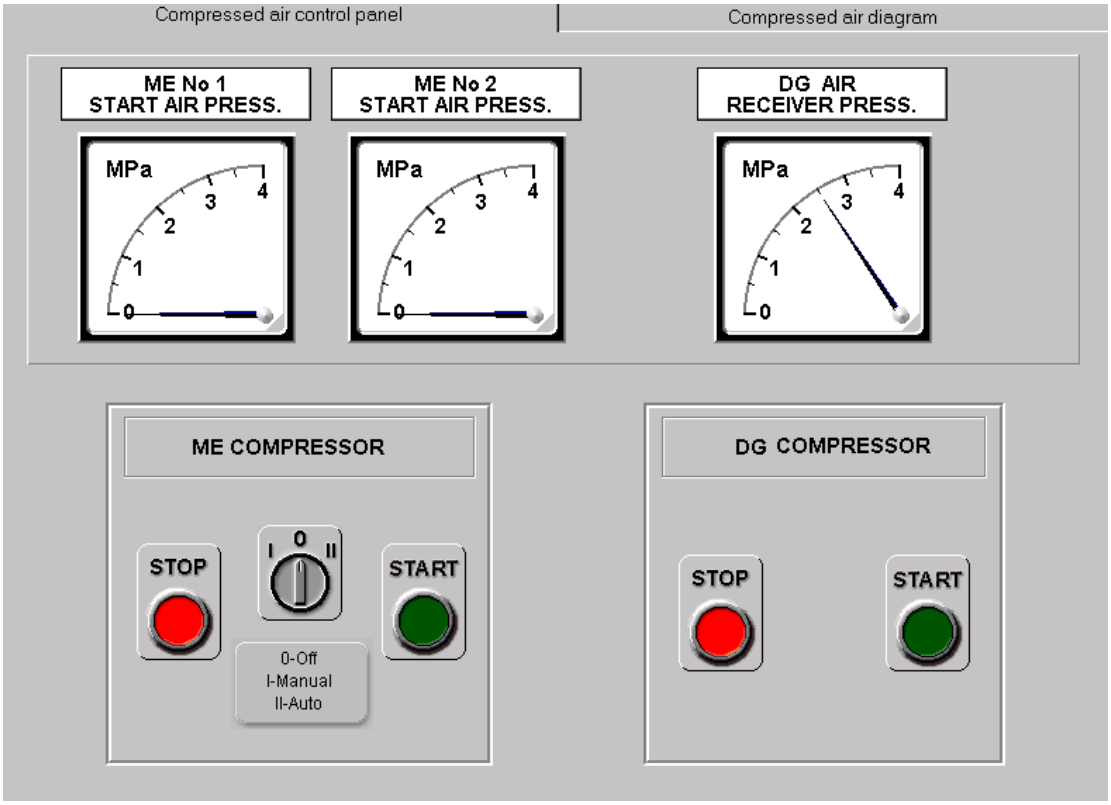


Fig. 4.10 Compressed air system control panel

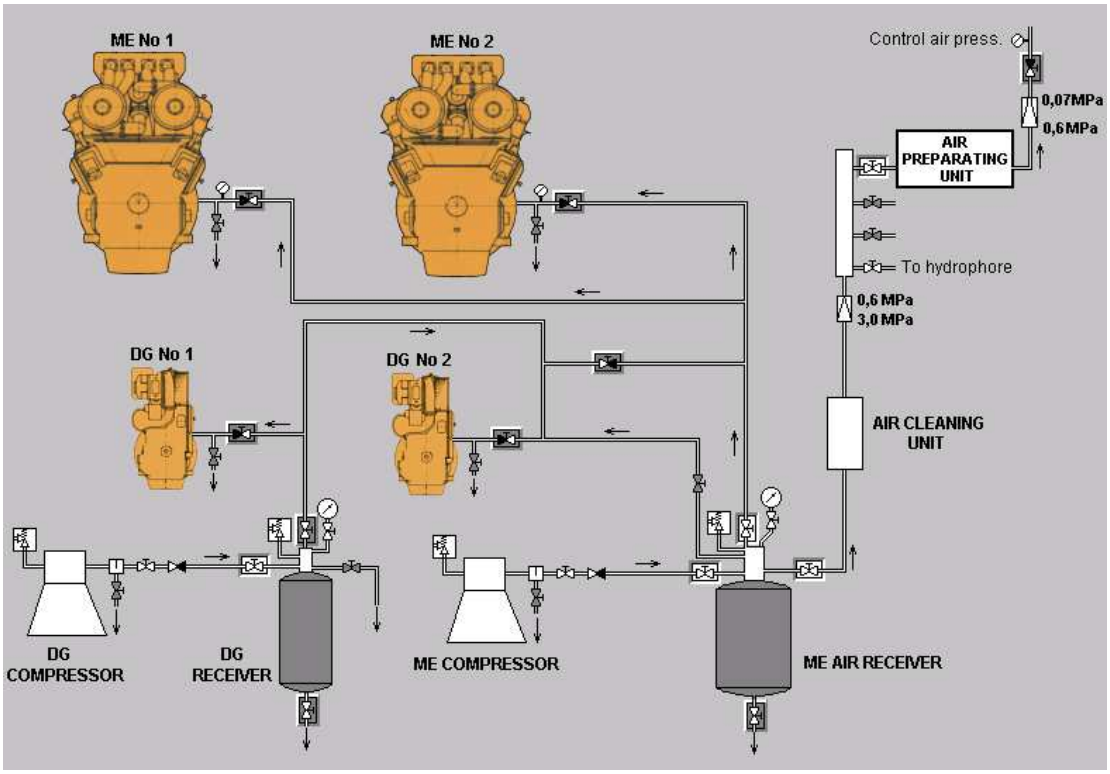


Fig. 4.11 Compressed air system diagram

The system consists of:

a. one ME compressor
b. one DG compressor
c. one ME air receiver
d. one DG air receiver
e. one air cleaning unit
f. one control air preparating unit

The ME compressor control mode can be manual or auto /compressor starts at air pressure 2.3 MPa and stops at 3.0 MPa/.
The compressed air for engine start is delivered directly from receivers. Air for control and auxiliary purposes is conducted through pressure reducing valves.

4.10 Reduction gear lubricating and control system

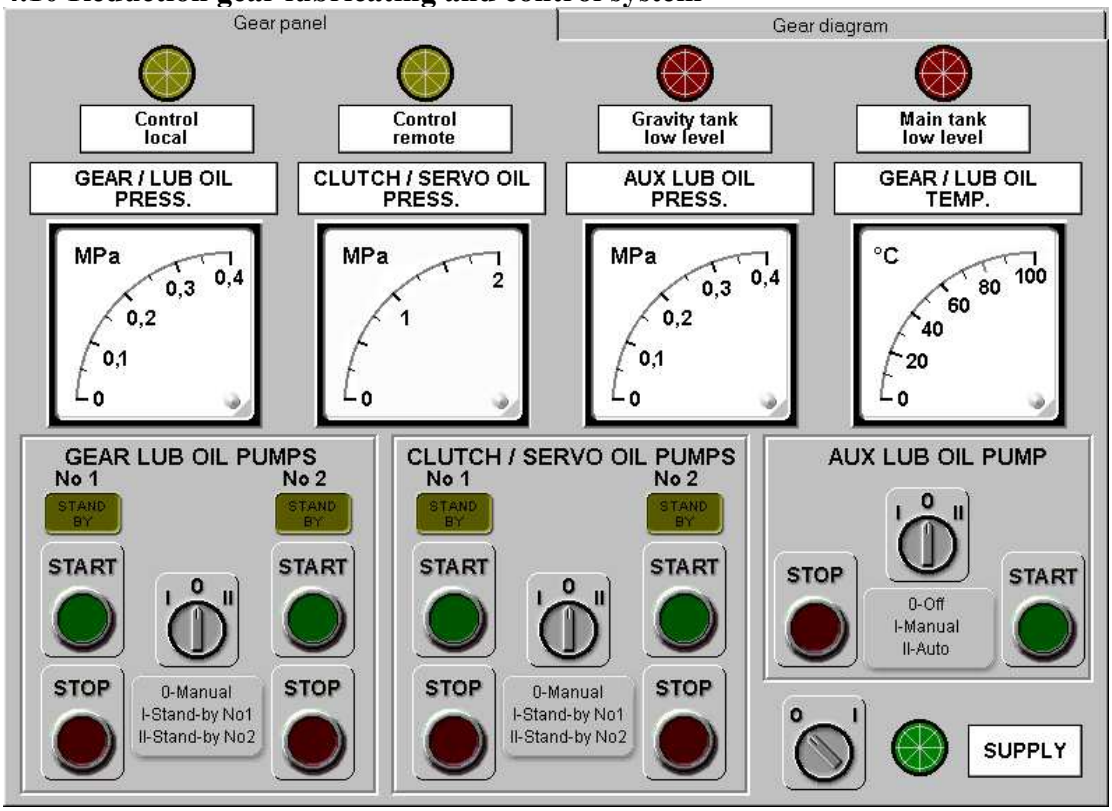


Fig. 4.12 Reduction gear lubricating and control system panel

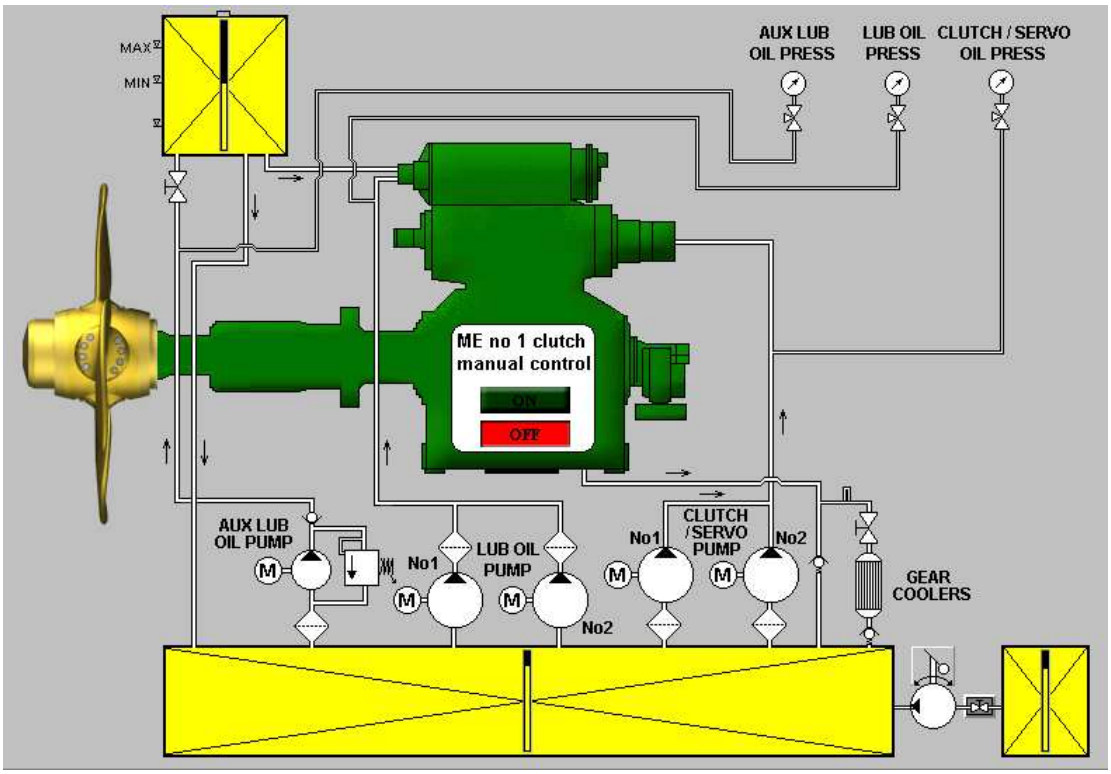


Fig. 4.13 Reduction gear lubricating and control system diagram

Reduction gear lubricating and control system consists of:

a. two reduction gear lubricating oil pumps
b. two clutch/servo oil pumps
c. one auxiliary lubricating oil pump
d. two reduction gear coolers
e. one main oil tank
f. one gravity lubricating oil tank

One reduction gear lubricating oil pump should always be set on **ON** and the other on **STANDBY** position. In the event the operating pump stops due to a fault, the other one will be able to take over the duty of the faulty pump.

Just as reduction gear pumps, one clutch/servo oil pump should always be set to **ON** and the other on **STANDBY** position.

The auxiliary lubricating oil pump can be operated in automated **AUTO** or in manual **MANUAL** mode. When working in the automated mode, the pump will start when the oil level in the gravity lubricating oil tank reaches the low limit level and stop when the level reaches the upper limit. The start lamp always lights when the pump is working.

Reduction gear can be operated remote (bridge or control room) and local.
Remote clutching can be realized by clutch push buttons located on the console. In this case, local clutch buttons are inactive.
Local clutching can be realized directly by push buttons located on the reduction gear (ME No 1 clutch manual control). In this case, remote control is impossible. Because only ME No 1 can be started and operated manually from the local control panel it is possible to clutch also only ME No 1.

4.11 Controllable pitch propeller /CPP/ lubricating and control system

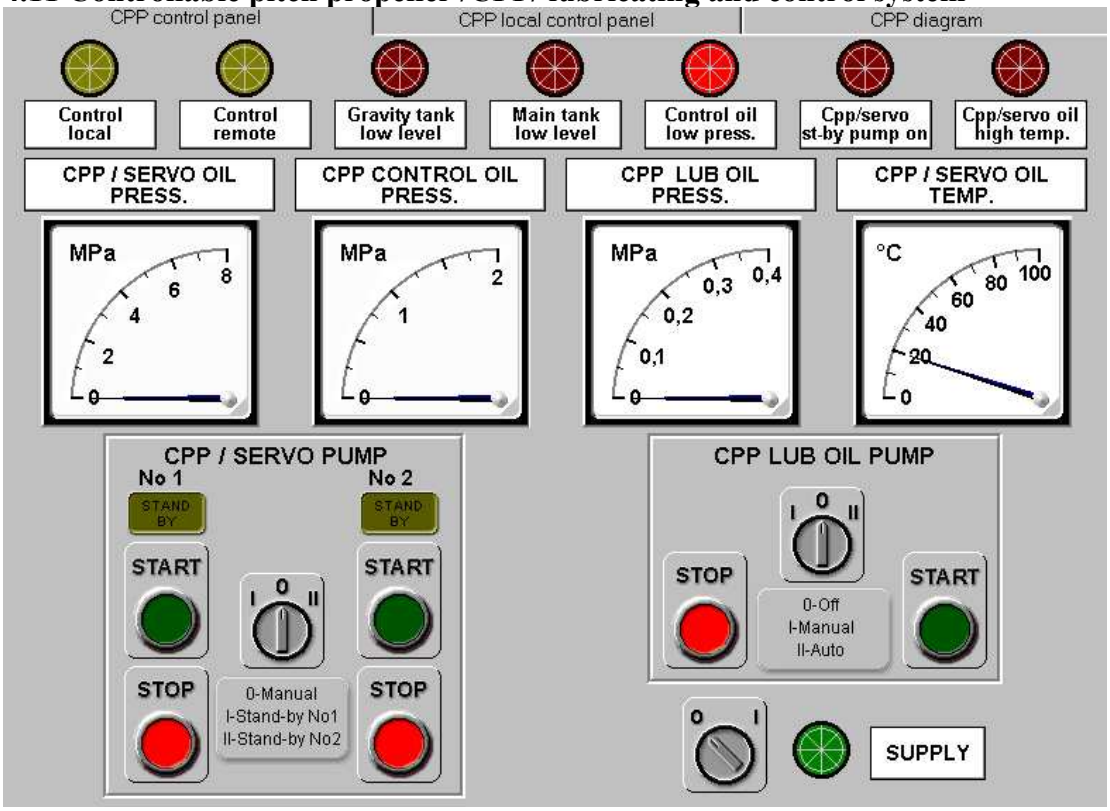


Fig. 4.14 Controllable pitch propeller system /CPP/ control panel

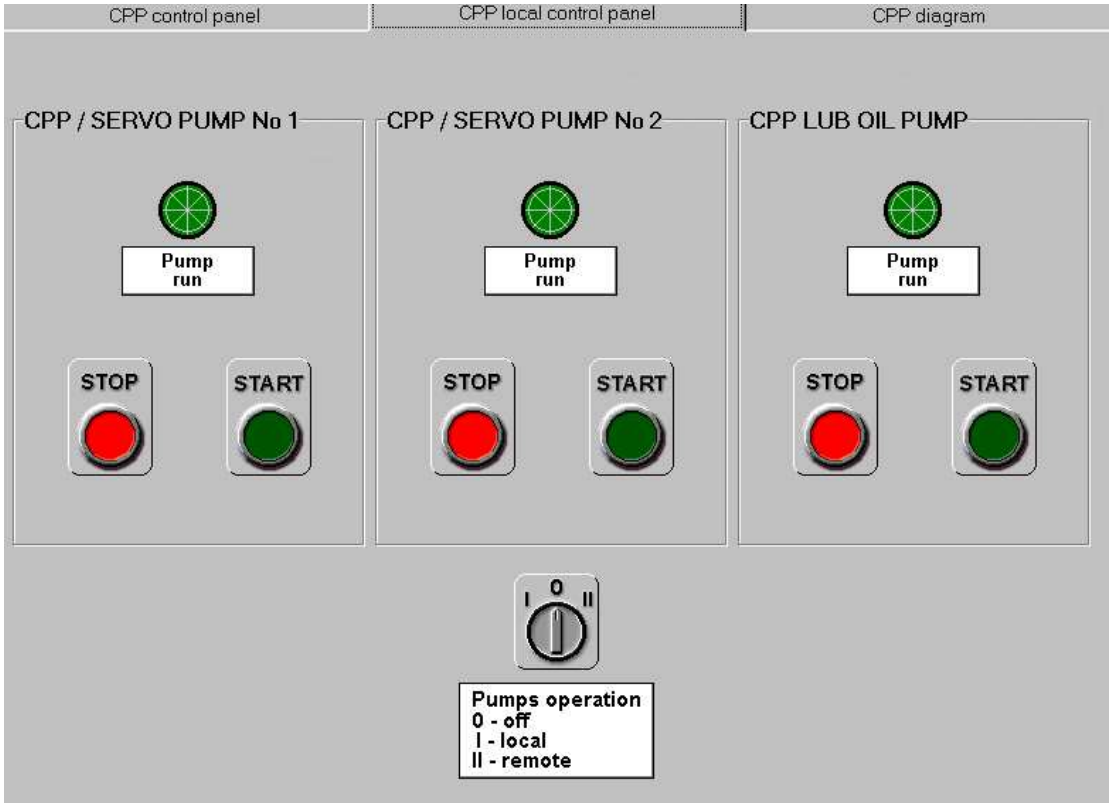


Fig. 4.15 Controllable pitch propeller system /CPP/ local control panel

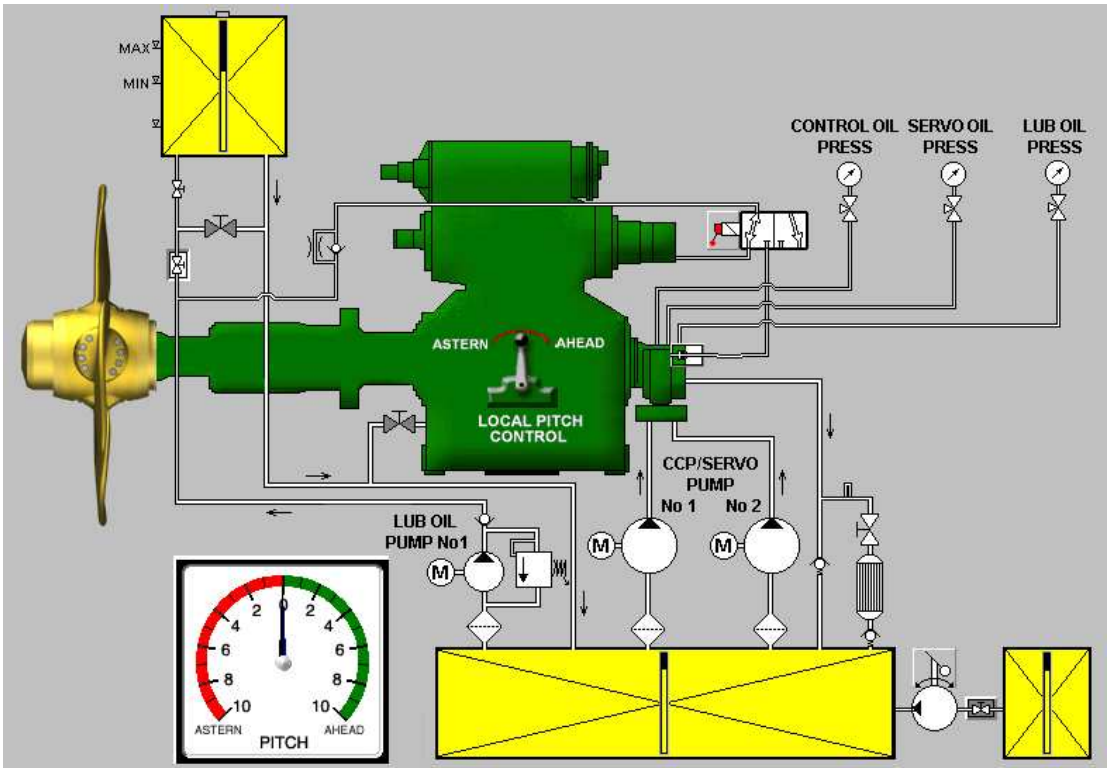


Fig. 4.16 Controllable pitch propeller system /CPP/ lubricating and control system

Controllable pitch propeller lubricating and control system consists of:

a. two CPP/servo and control oil pumps
b. one lubricating oil pump
c. two CPP coolers
d. one main oil tank
e. one gravity lubricating oil tank
f. local pitch control lever

One CPP/servo and control oil pump should always be set on **ON** and the other on **STANDBY** position. In the event the operating pump stops due to a fault, the other one will be able to take over the duty of the faulty pump.

The lubricating oil pump can be operated in automated **AUTO** or in manual **MANUAL** mode. When working in the automated mode, the pump will start when the oil level in the gravity lubricating oil tank reaches the low limit level and stop when the level reaches the upper limit. The start lamp always lights when the pump is working.

C.P.P. installation may operate in one of the following operation modes during its exploitation:

- *Basic operation* : one of the main pump aggregates works with remote pitch propeller control from the bridge or control room (follow-up).

- *Emergency operation* at which one of the main pump aggregate works with local pitch control lever.

- *Emergency operation* at which main pump aggregates do not work and the pitch propeller control in **AHEAD** direction is done by means of the lubricating pump aggregate.

4.12 Propulsion system

Propulsion system general view is shown on Fig. 4.17 and allows for:

a. ME indicator's valves opening/closing
b. ME turning gear on/off operation

Digital exhaust gases temperature monitoring panel is also included in propulsion system general view.

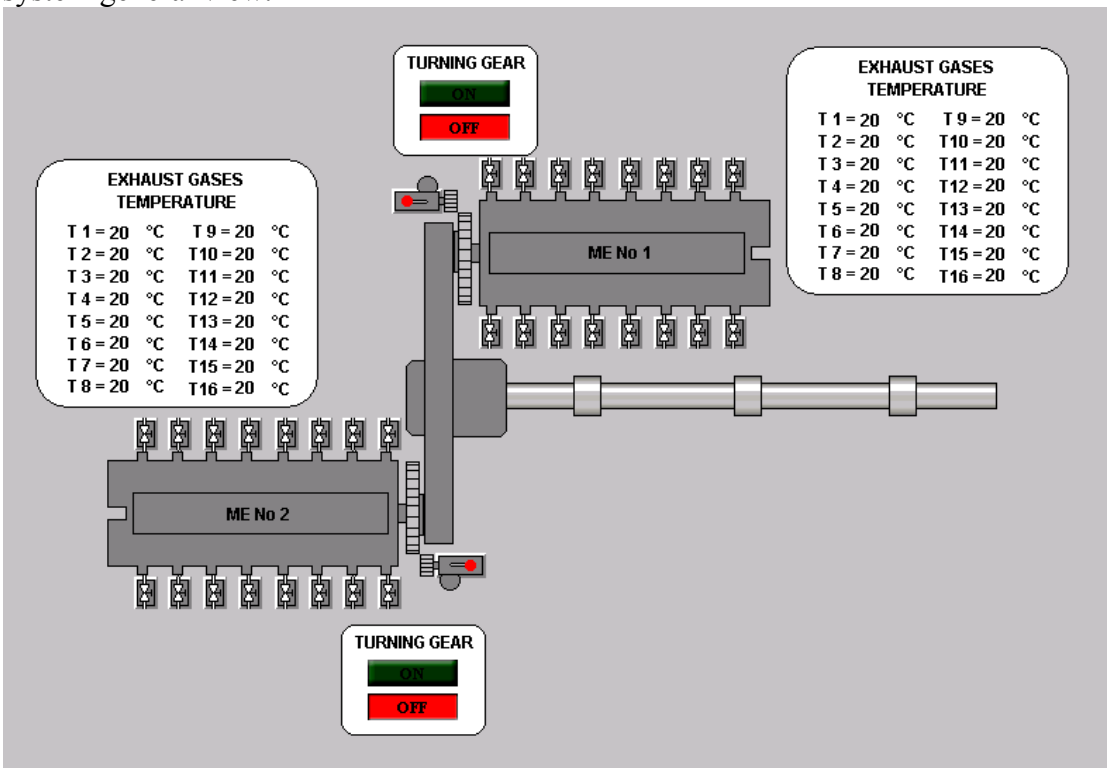


Fig. 4.17 Propulsion system general view

4.13 Main Engine No 1 Local Panel

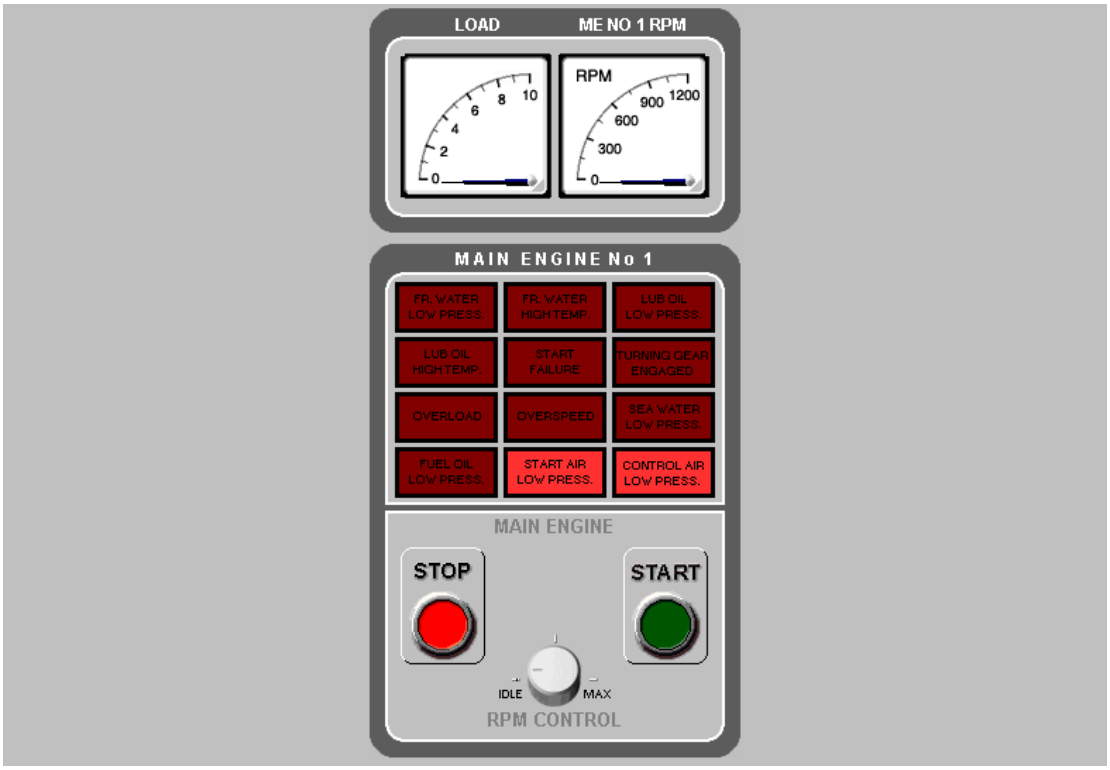


Fig. 4.18 Main Engine No 1 Local Panel

This panel is implemented specially for emergency situations when the engine and propulsion system is controlled in the **local** mode. After changing steering from remote mode (**control room** or **bridge**) to **local**, engines are automatically disengaged and their speed is reduced. In this moment clutching and changing propeller speed is possible only from the local control panel.
If ME No 1 stops, it must be started manually from the ME No 1 Local Panel.
In local control mode the maximum engine speed is limited to 600 rpm and only ME No 1 can be operated in this mode.

4.14 Diesel engine generators system

The purpose of diesel engine generators system is to supply electric power for all the systems and the devices.

The system consists of the following elements and panels:

a. two DG
b. one EM DG
c. control panel Fig.4.19
d. main switchboard panel Fig. 4.20
e. EM DG panel Fig. 4.21
f. emergency switchboard panel Fig. 4.22
g. electric diagram panel Fig. 4.23

Generators are operated in a semi-automatic way.

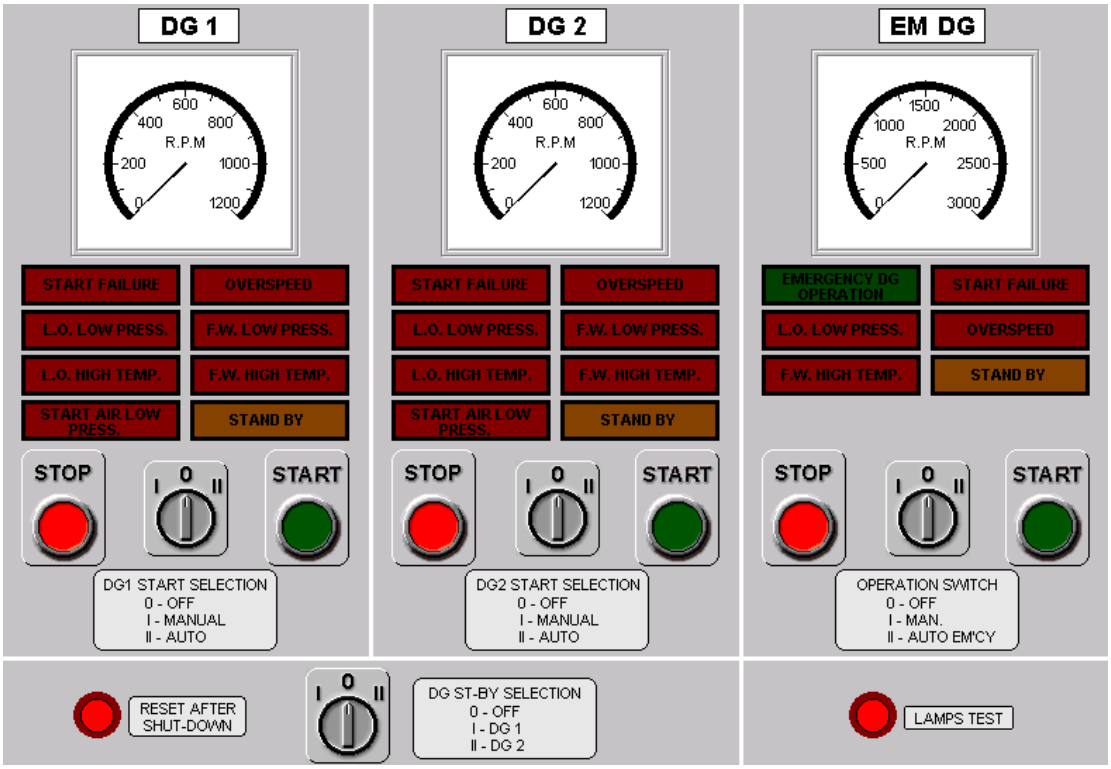


Fig. 4.19 Diesel Engine Generator's Control Panel

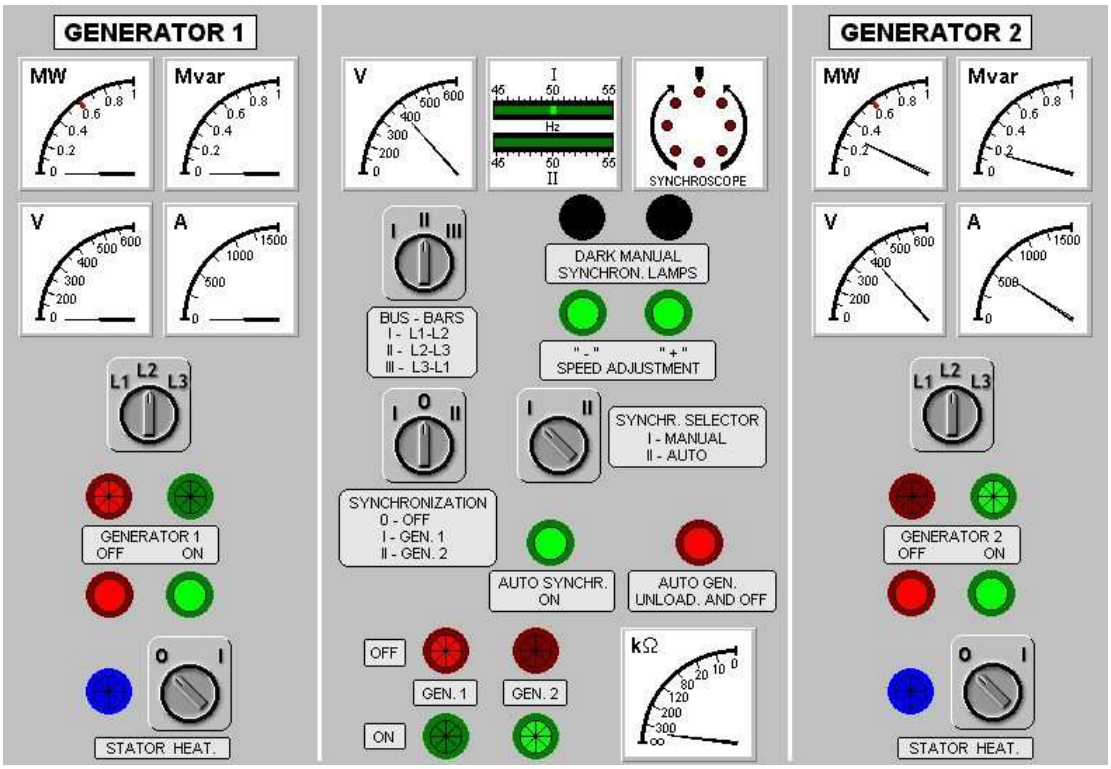


Fig. 4.20 Main Switchboard

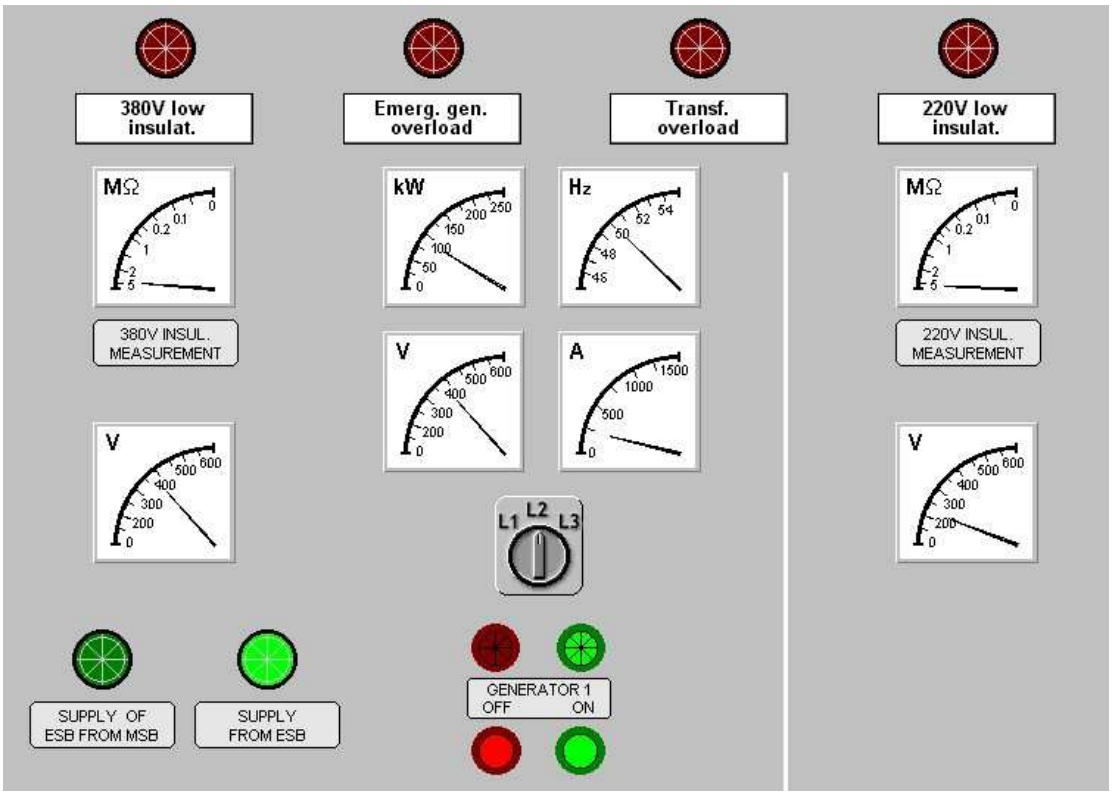


Fig. 4.21 Emergency diesel generator

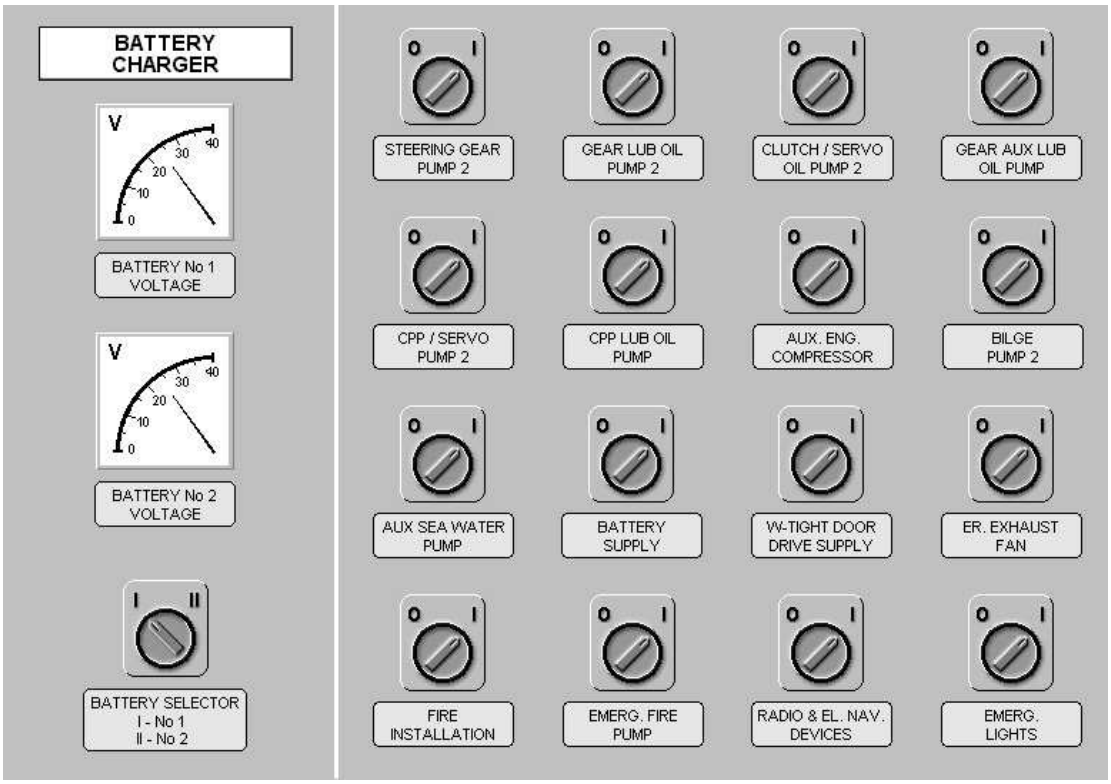


Fig. 4.22 Emergency switchboard

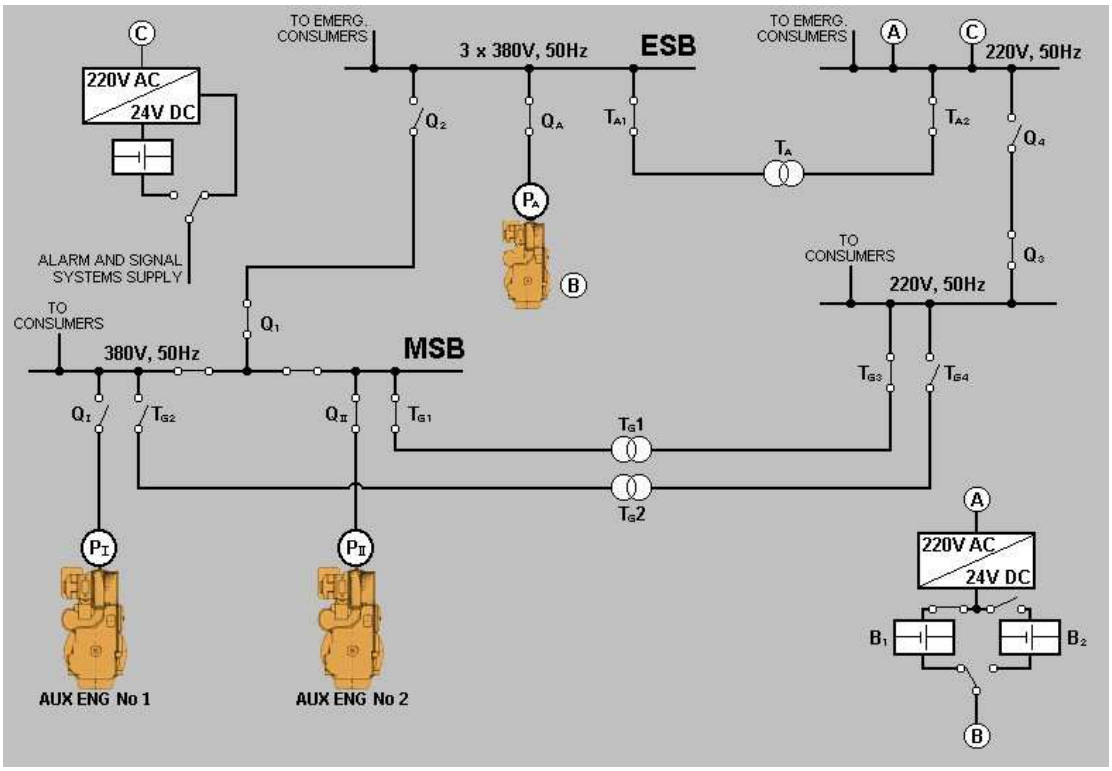


Fig. 4.23 Generator's electric diagram

4.15 Bilge and Ballast System

This system consists of two separate systems with one common control panel.

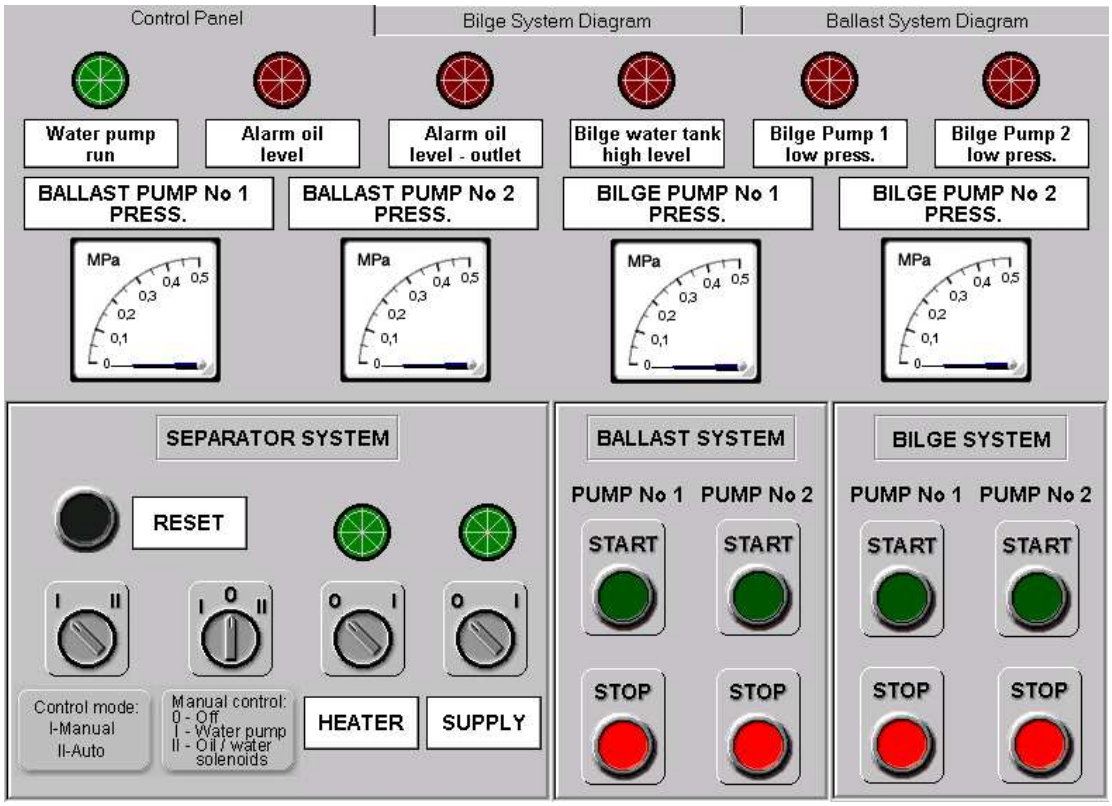


Fig. 4.24 Bilge and Ballast system control panel

Bilge system

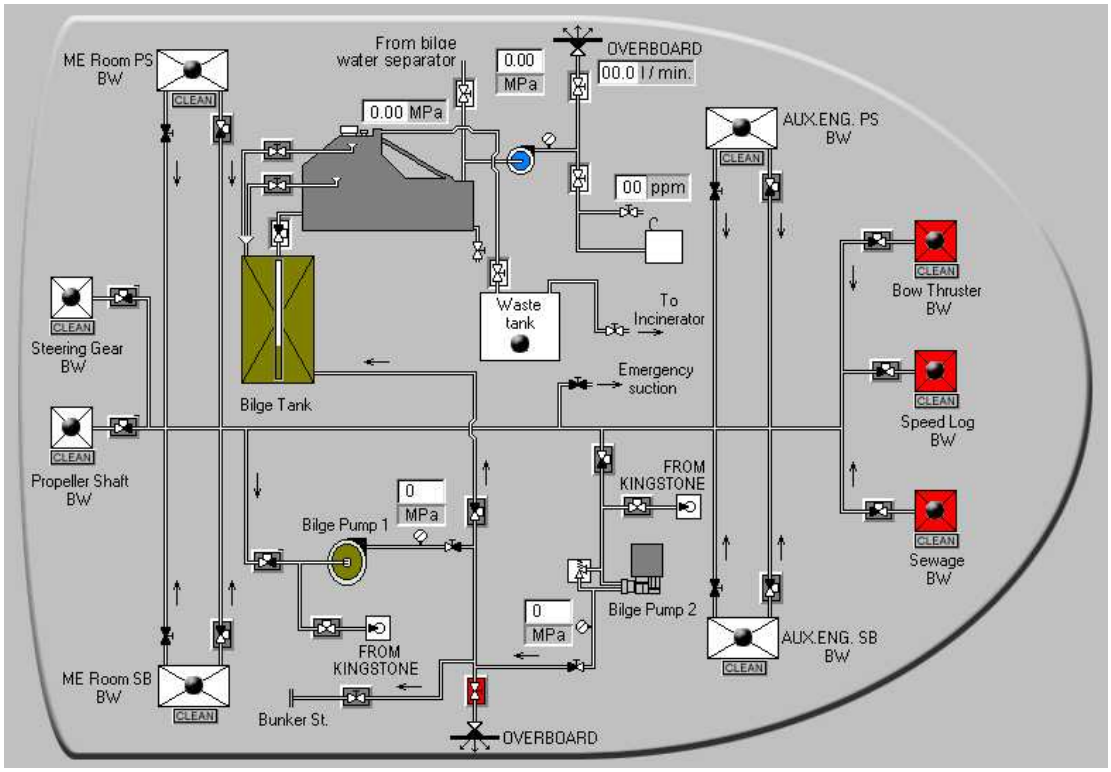


Fig. 4.25 Bilge system diagram

The system consists of the following elements:

a. one centrifugal bilge pump
b. one displacement bilge pump
c. one bilge water tank
d. oily water separator
e. bilge studs

The bilge system includes nine bilge studs:

a. steering gear
b. propeller shaft
c. ME Room SB
d. ME Room PS
e. AUX. ENG. SB
f. AUX. ENG. PS
g. Sewage
h. Speed log
i. Bow thrusters

Each bilge has a well and the related alarm controlled by the bilge level. Each bilge pump has to be primed , this means that before starting the pump, it's suction side has to be filled by sea water from KINGSTONE.
Each bilge sea strainer has to be cleaned periodically by using **Clean** button located under adequate bilge stud.
This operation is slightly different for each pump type. The bilge water is collected in a separate tank and when the level in this tank reaches the upper limit, it has to be

pumped out to the oily water separator. This is necessary because bilge water discharges must contain less than 15ppm of oil under the current IMO regulations. The overboard discharge is sampled through an oil content meter. Prior to start-up and shutdown the oily water separator must be flushed through with clean sea water. This is done automatically when the separator operates in the automated mode and its operation is controlled by the level in the bilge water tank. The separator can be also operated in the manual mode.

Ballast System

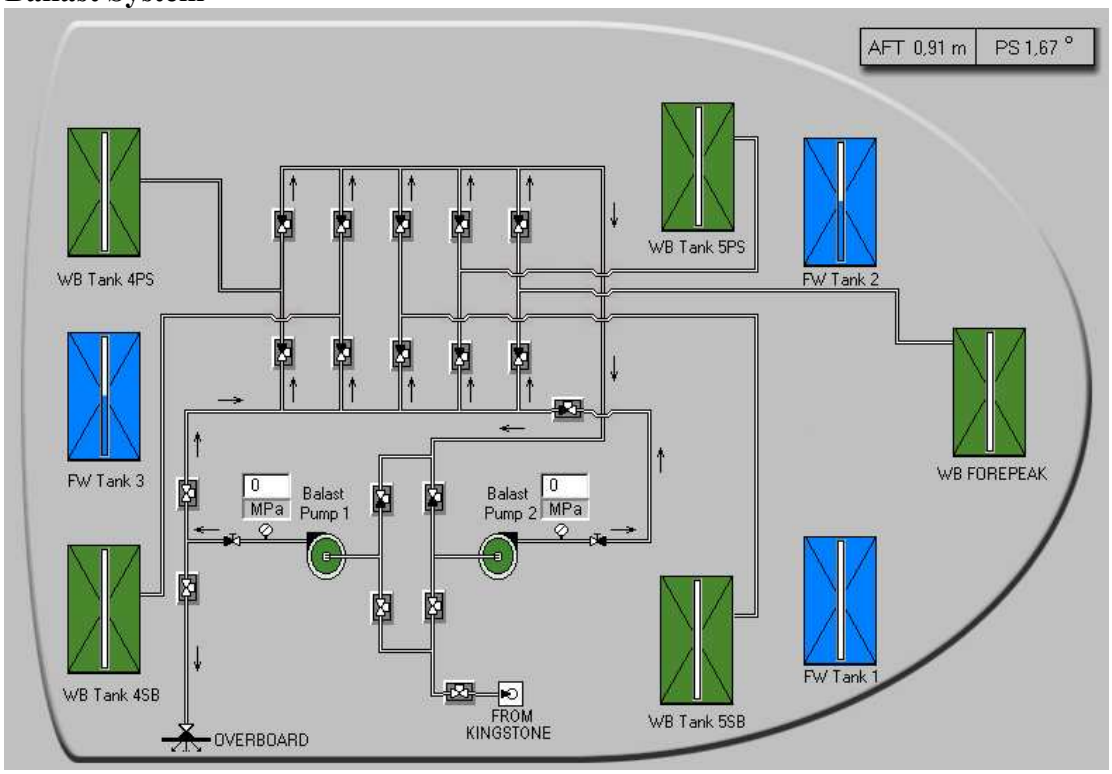


Fig. 4.26 Ballast system diagram

The ballast system includes five example ballast tanks with valves, piping system and ballast pumps.
Fresh water tanks are also included in ballast system diagram because they have an impact on the ship heel and trim.

4.14 Steering gear system

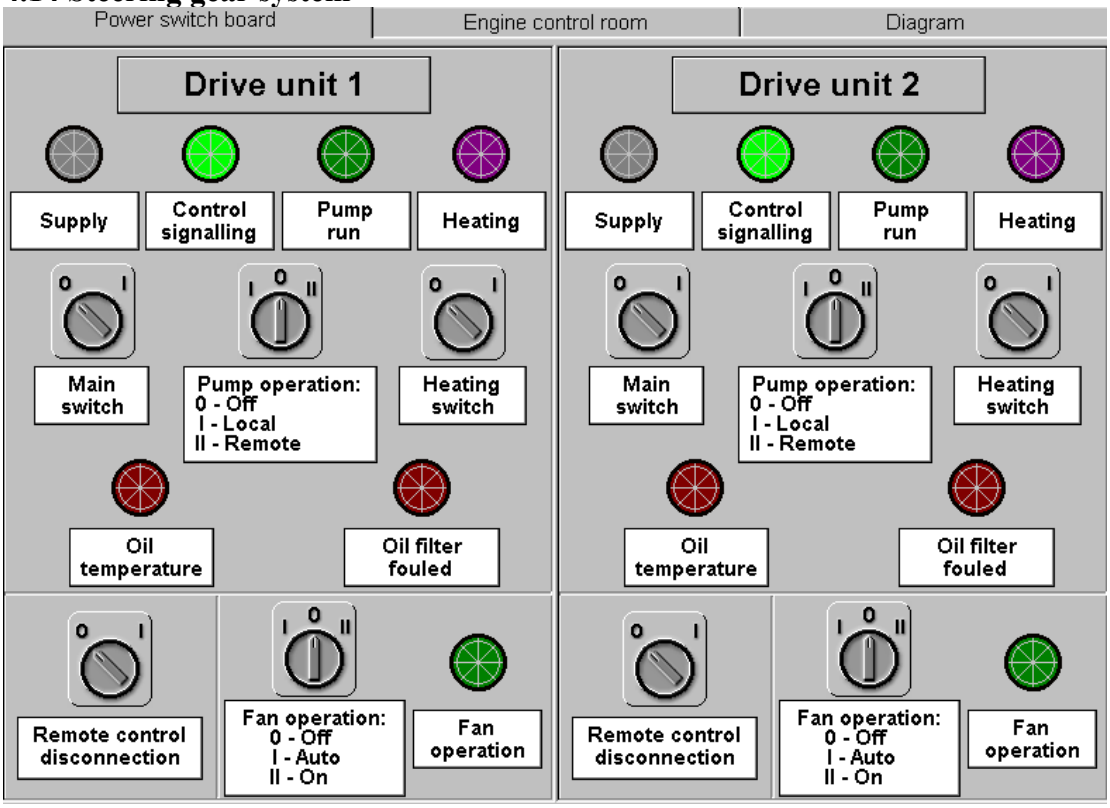


Fig. 4.27 Steering gear power switch board

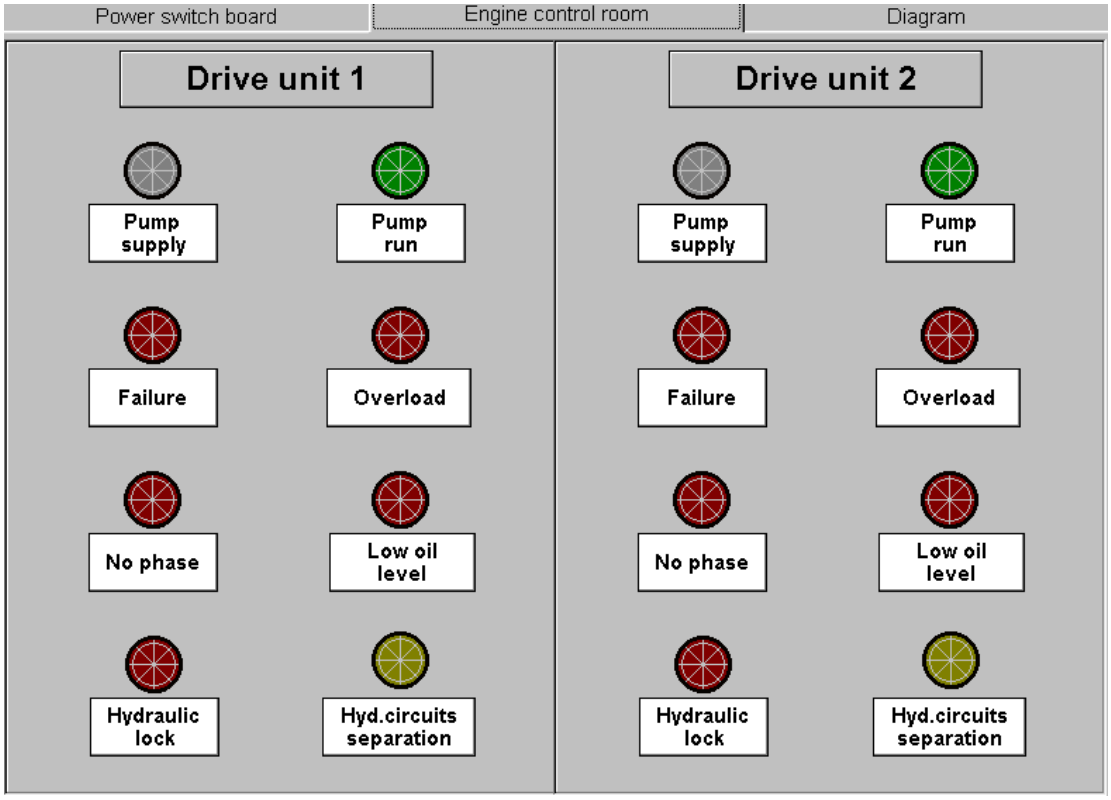


Fig. 4.28 Steering gear control room

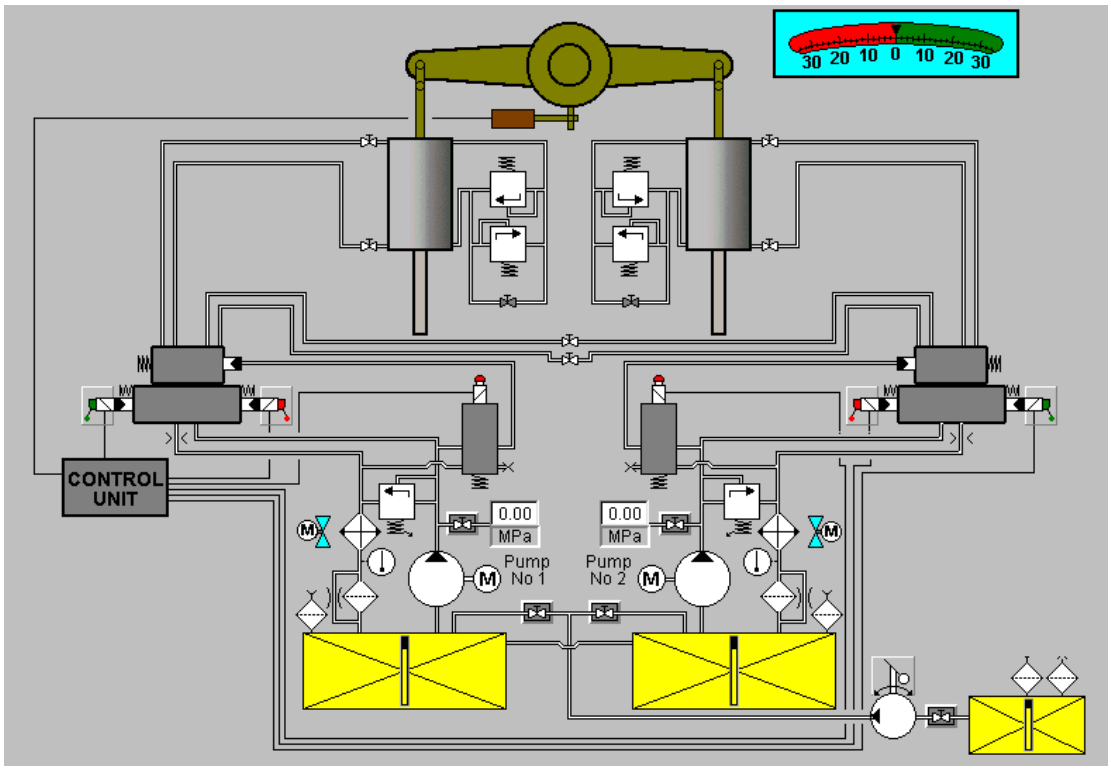


Fig. 4.29 Steering gear diagram

The steering gear (with the rudder) besides the ME is one of the most important ship devices, it ensures the ship operational safety. This device performs the following two basic tasks:

- keeps right course of the ship,
- changes course of the ship in order to manoeuvre it.

The steering gear presented above is an example of electro hydraulic steering devices i.e. driving of the rudder is performed in a hydraulic way while its movement of control is carried out in an electro hydraulic way.
This steering gear consists of two hydraulic cylinders with two pistons inside (defined as rudder actuator unit). The pistons affect the rudder tiller by means of the strand assembly and the rudder tiller affects the rudder stock directly. This action causes the movement of the rudder blade. The nominal pressure is approx. 16 MPa (the maximal pressure, which opens safety valves equals to 20 MPa) and it is generated by two independent gear pump drive units. The high pressure of installation may be measured by pressure gauges (by opening the manometer valves). During the steering gear operation, manometer valves should be closed because of the risk of damage by high pressure in installation. The steering gear is ready for work when one or both electric motors are put into service. The electric motor drives the pump, which pumps oil further into installation.

4.16 Fire Fighting System

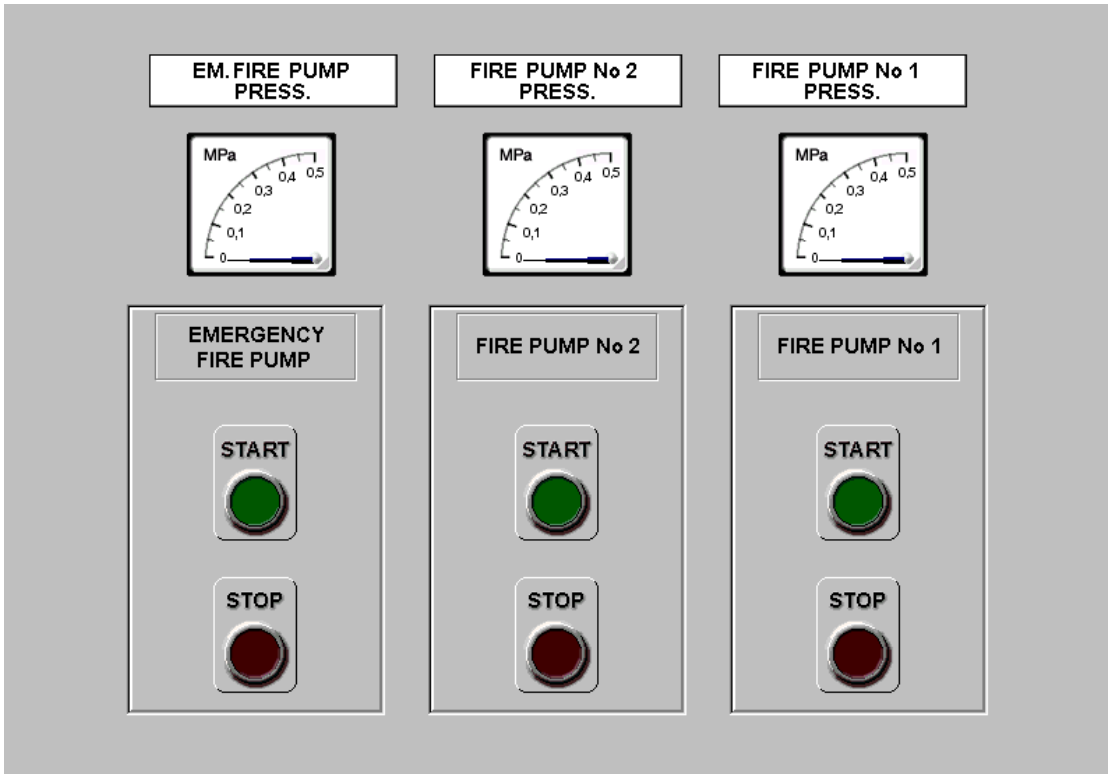


Fig. 4.30 Fire fighting system control panel

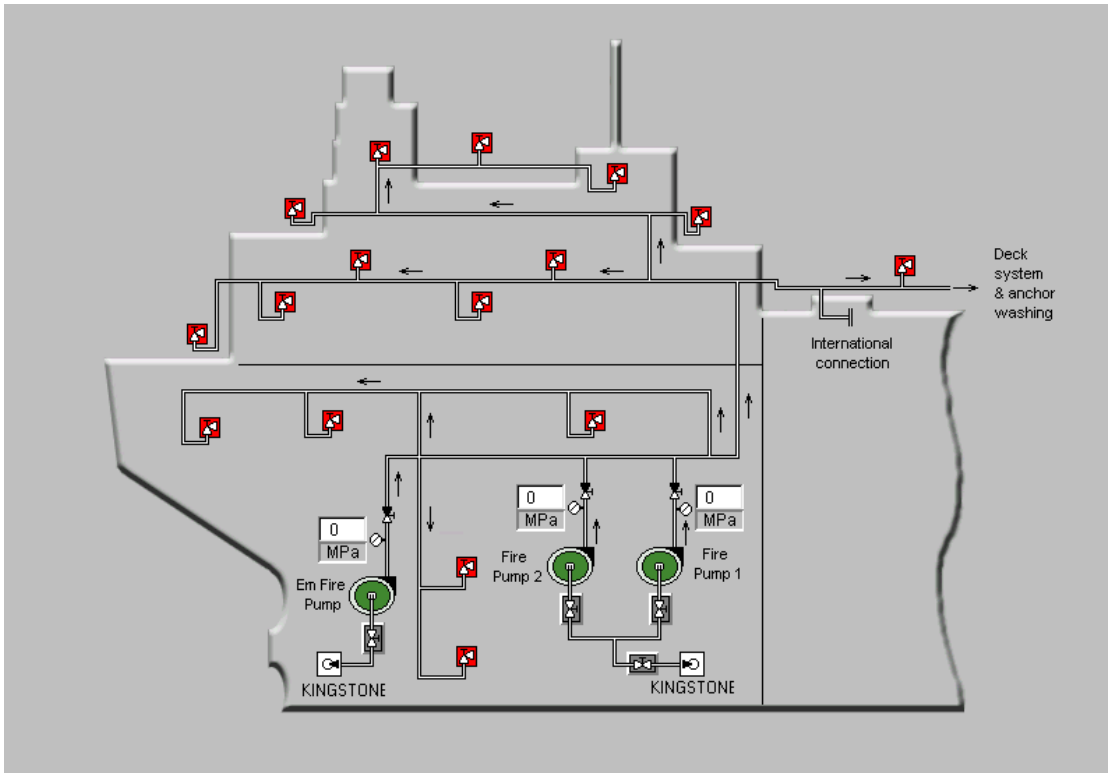


Fig. 4.31 Fire fighting system diagram

The fire fighting system includes two fire pumps driven by electric motors and one independent emergency fire pump driven by an independent diesel engine. The emergency fire pump is also connected to a separate sea water chest and is located outside the engine room.

4.17 Sanitary Water System

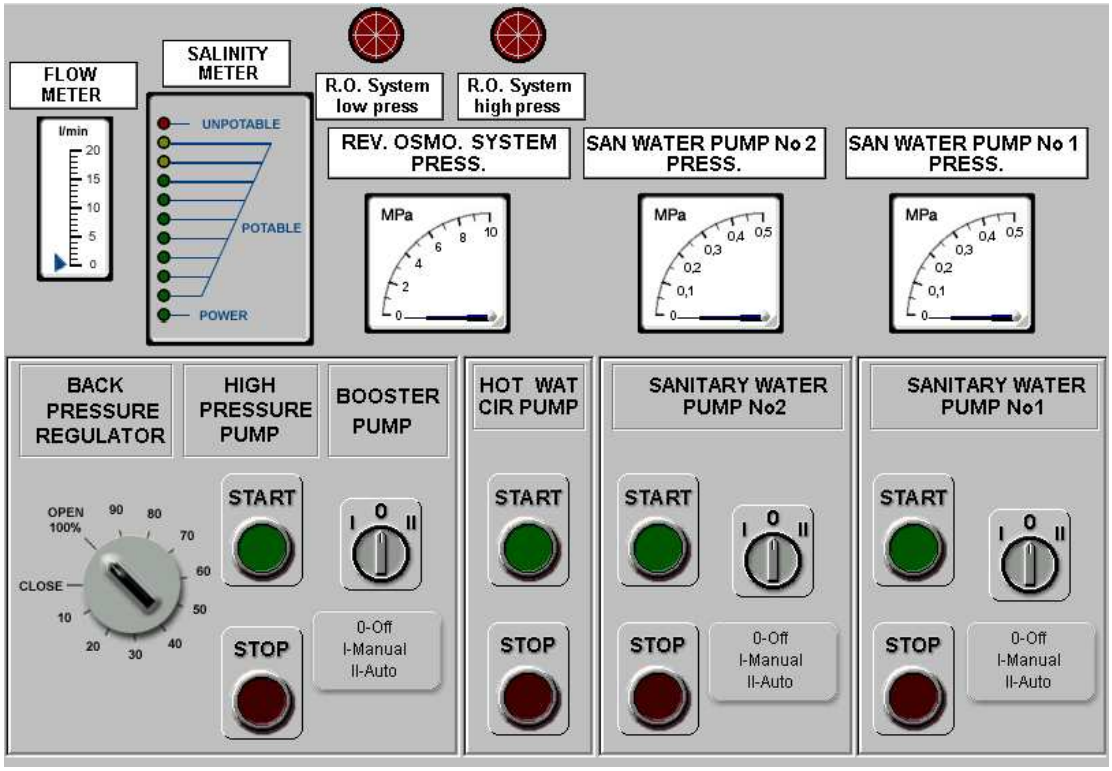


Fig. 4.32 Sanitary water system control panel

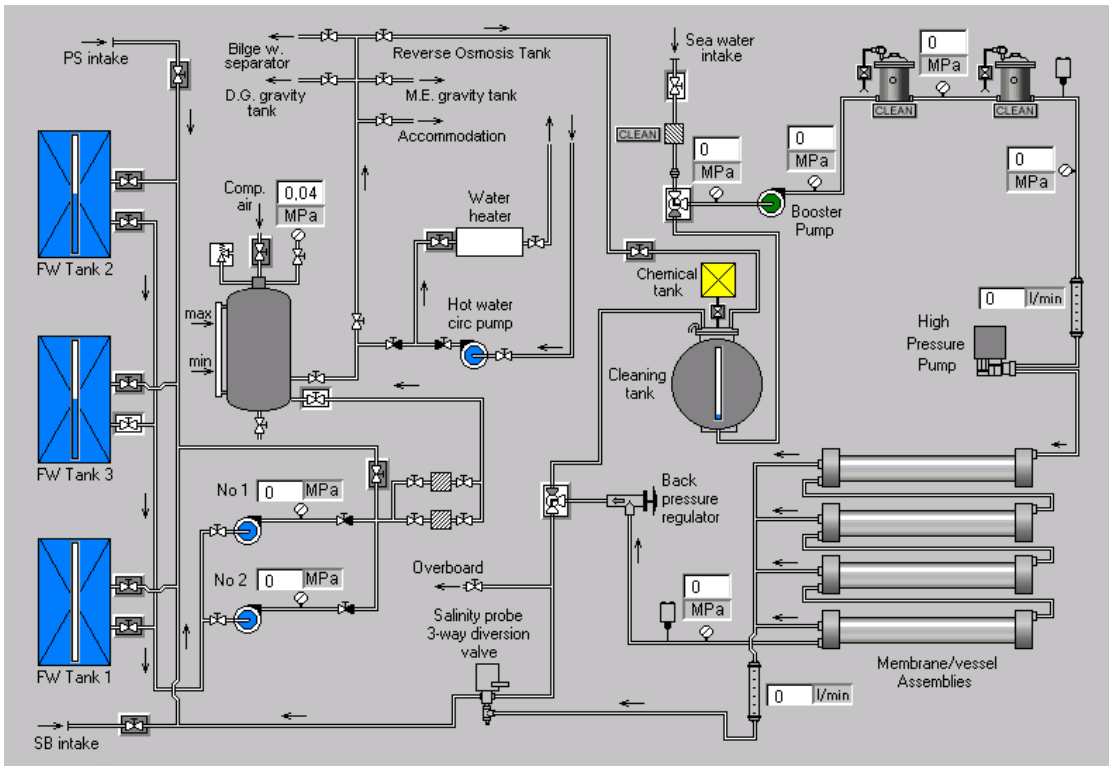


Fig. 4.33 Sanitary water system diagram

Sanitary water system consists of:

a. three fresh water tanks
b. two fresh water supply pumps
c. hydrophore tank
d. hot water circulating pump
e. water heater
f. reverse osmosis desalination system

Reverse osmosis desalination system consists of:

a. booster pump
b. filters
c. high pressure pump
d. reverse osmosis membranes
e. back pressure regulator valve
f. salinity probe, three – way diversion valve
g. cleaning tank
h. chemical tank

The sanitary water system aim is to supply sanitary water to the receivers by keeping a determined pressure in the installation. These are following receivers:

a. ME gravity tank
b. DG gravity tank
c. bilge water separator
d. reverse osmosis cleaning tank
e. accommodation

Fresh water supply pumps are centrifugal type and can be operated in automated **AUTO** or in manual **MANUAL** mode. When working in the automated mode the pump is controlled by the differential pressure control. The pump will start when the pressure in the hydrophore tank decreases to 0.3 MPa and stop when the pressure increases to 0.6 MPa.

The water level in the hydrophore ought to be related with pressure, it means that in the event the pressure is equal to 0.3 MPa (the moment of pump starting), the water level should be at minimum (**min** marked on right part of the vessel). In the event the pressure is equal to 0.6 MPa the water level should correspond to maximum **max**.

The purpose of the reverse osmosis desalination system is to produce potable fresh water from sea water, by taking advantage of the osmosis phenomenon.

Feed Water (Sea Water) is pumped into the System via an Inlet Sea Cock Valve, then filtered through a raw water Sea Strainer. The pressure level of the Feed Water is then increased by the Booster Pump and filtered once more through dual stage tight micron Prefilters. Oil, if present, is now separated and removed through the optional Oil/Water Separator . A Low Pressure Switch shuts down the System in the event of low flow condition. This prevents cavitation in the High Pressure Pump. The Feed Water flow is measured by the Feed Water Flow Meter to ensure proper operation of the High Pressure Pump.

The High Pressure Pump increases the filtered Feed Water to a high pressure level and forces it into the Membrane Vessel Assembly. The Back Pressure Regulator controls and automatically maintains the necessary high pressure level in the membrane. Concentrated brine is discharged through the Brine Discharge connector and diverted back to the feed source.

The Produced Water flows out of the R.O. Membrane and passes into a Produced Water Flow Meter where the amount of Potable Water produced is registered. Next, the Salinity Probe adjusts automatically for temperature changes and registers, electronically, the salt content of the Produced Water. The Produced Water then proceeds into the 3-Way Solenoid Directional Valve. Here, Produced Water is diverted to the Carbon Filter where gases or odors present are absorbed and removed from the Produced Water.

4.18 Refrigerating System

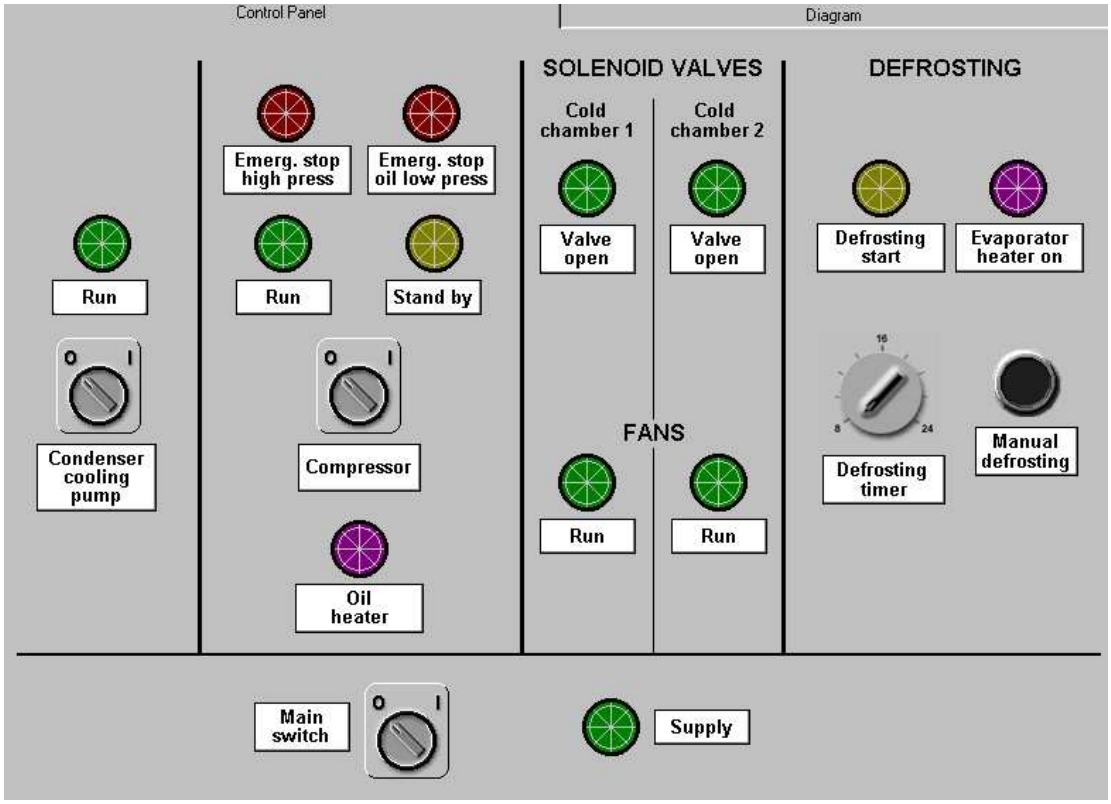


Fig. 4.44 Refrigerating system control panel

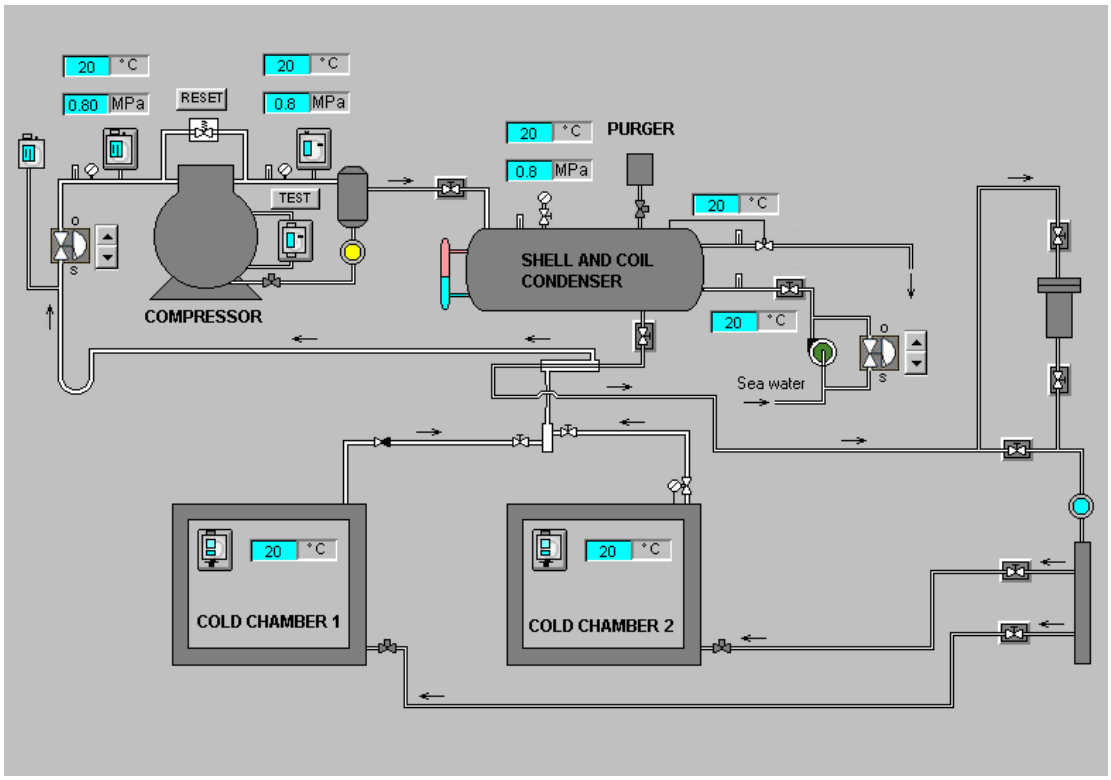


Fig. 4.45 Refrigerating system diagram

The refrigerating plant diagram consists of:

a. piston compressor
b. automatic oil separator
c. dehydrator
d. shell and coil condenser,
e. two cold chambers (chamber 1 - minus temperature, chamber 2 - plus temperature)

The system is based on a refrigerating plant with two cold chambers . The cold chamber No 1 serves to obtain minus temperatures ranging from - 30 to - 15 °C while the cold chamber 2 serves to achieve temperatures from 0 to +15 °C. The chambers are serviced by one piston compressor. The refrigerant medium is freon R 22.

4.19 Hardware console gauges, indication and alarm lamps description

Gauges description

No	Gauge	Nominal value	Alarm value	Max. scale range	Remarks
1	**CONTROL AIR PRESS**	0.07	0.05	0.10	(MPa)
2	**ME No 1 LOAD**			10	(-)
3	**ME No 1 RPM**		1050	1200	(rev./min.)
4	**PITCH**		- 9 / + 9	- 10 / + 10	(-)
5	**SHAFT RPM**		260	300	(rev./min.)
6	**ME No 2 RPM**		1050	1200	(rev./min.)
7	**ME No 2 LOAD**		-9 / + 9	- 10 / + 10	(-)
8	**START AIR PRESS**	2.3 – 3.0	2.2	4.0	(MPa)
9	**ME No 1 START AIR PRESS**	2.3 – 3.0	2.2	4.0	(MPa)
10	**ME No 2 START AIR PRESS**	2.3 – 3.0	2.2	4.0	(MPa)
11	**AUX AIR RECEIVER PRESS**			4.0	(MPa)
12	**ME No 1 LUB OIL PRESS**	0.3	0.2	0.4	(MPa)
13	**ME No 1 LUB OIL TEMP**	50	80	100	(ºC)
14	**ME No 2 LUB OIL PRESS**	0.3	0.2	0.4	(MPa)

15	**ME N0 2 LUB OIL TEMP**	50	80	100	(ºC)
16	**ME No 1 FUEL OIL PRESS**	0.4	0.2	0.8	(MPa)
17	**ME No 2 FUEL OIL PRESS**	0.4	0.2	0.8	(MPa)
18	**ME No 1 FW PRESS**	0.3	0.2	0.4	(MPa)
19	**ME No 1 FW TEMP**	60	80	100	(ºC)
20	**ME No 2 FW PRESS**	0.3	0.2	0.4	(MPa)
21	**ME No 2 FW TEMP**	60	80	100	(ºC)
22	**ME No 1 SW PRESS**	0.2	0.1	0.4	(MPa)
23	**ME No 2 SW PRESS**	0.2	0.1	0.4	(MPa)
24	**SW TEMP**			100	(ºC)
25	**AUX SW PUMP PRESS**	0.2		0.4	(MPa)
26	**GEAR LUB OIL PRESS**	0.3	0.2	0.4	(MPa)
27	**CLUTCH/SERVO OIL PRESS**	1.6	1.2	2.0	(MPa)
28	**GEAR AUX LUB OIL PRESS**	0.2		0.4	(MPa)
29	**GEAR LUB OIL TEMP**	50	80	100	(ºC)
30	**CPP/SERVO OIL PRESS**	5.0	4.0	8.0	(MPa)
31	**CPP CONTROL OIL PRESS**	1.5	1.2	2.0	(MPa)
32	**CPP LUB OIL PRESS**	0.2		0.4	(MPa)
33	**CPP/SERVO OIL TEMP**	50	80	100	(ºC)

PROPULSION panel lamps description

INDICATION lamps

1. **CONTROL SYSTEM ON**
2. **PROPELLER PITCH 0**
3. **GEAR LUB. PUMP ON**
4. **CLUTCH/SERVO PUMP ON**
5. **CPP/SERVO PUMP ON**
6. **CPP LUB OIL PUMP**

ALARM lamps

1. **GEAR LUB. OIL HIGH TEMP.**
2. **GEAR LUB. OIL LOW PRESS.**
3. **CLUTCH/SERVO OIL LOW PRESS**
4. **CPP/SERVO OIL LOW PRESS**
5. **SLOW DOWN**
6. **PROPELLER PITCH BLOCKED**
7. **GEAR LUB. STAND-BY PUMP ON**
8. **CLUTCH/SERVO STAND-BY PUMP ON.**
9. **CPP/SERVO STAND-BY PUMP ON.**
10. **GEAR BEARINGS HIGH TEMP.**
11. **PROPELLER BEARINGS HIGH TEMP.**
12. **CPP/SERVO OIL HIGH TEMP.**

Attention: In the simulator software version the alarms lamps pos. 7 – 12 are placed in control panels of the adequate system.

ME No 1 / No 2 panel - lamp's description

A. INDICATION lamps

1. **CONTROL SYSTEM ON**
2. **PRELUB. PUMP ON**
3. **ENGINE READY FOR START**
4. **ENGINE READY FOR CLUTCH**
5. **LOAD 90%**
6. **LOAD 100%**

B. ALARM lamps

1. **FRESH WATER LOW PRESS.**
2. **FRESH WATER HIGH TEMP.**
3. **LUB. OIL LOW PRESS.**
4. **LUB. OIL HIGH TEMP.**
5. **START FAILURE**
6. **TURNING GEAR ENGAGED**
7. **OVERLOAD**
8. **OVERSPEED**
9. **SEA WATER LOW PRESS.**
10. **FUEL OIL LOW PRESS.**
11. **START AIR LOW PRESS.**
12. **CONTROL AIR LOW PRESS.**

SYSTEMS ALARM panel lamp's description:

1. **MAIN ENGINE**
2. **FUEL SYSTEM**
3. **COOLING SYSTEM**
4. **LUBRICATING SYSTEM**
5. **COMPRESSED AIR SYSTEM**
6. **STEAM SYSTEM**
7. **DIESEL GENERATORS**
8. **BILGE AND BALLAST**
9. **STEERING GEAR**
10. **FIRE FIGHTING SYSTEM**
11. **SANITARY WATER SYSTEM**
12. **REFRIGERATING SYSTEM**

Obs.: Alarms mentioned in pos. 6, 8, 9, 10, 11 and 12 are not active (these alarms are placed on the panel in view of future simulator's development).

ME CONTROL MODE panel lamps/push buttons functioning description:

BRIDGE
- telegraph lamps inactive
- control system on
- alarm system on

CONTROL ROOM:
- telegraph lamps active
- control system on
- alarm system on

LOCAL:
- telegraph lamps inactive
- control system off
- alarm system on

Attention:
In case the push-button **LOCAL** will be pressed on **CONTROL MODE** panel during propulsion system operation, then ME (or engines) will decrease its revolution till 460 rev./min and in consequence the engine will be disengaged.

Attention:
Position of telegraph has no influence on propulsion control system operation.

5. Starting and stopping procedures

5.1 Diesel generators

A) Starting the engine

1. Switch on **SUPPLY** on simulator's console

Attention: After switching on the program and when **SUPPLY** is switched on, the following state of console is maintained:

- **CONTROL MODE** is in position **CONTROL ROOM**
- telegraph is set as **STOP**
- the following lamps on **PROPULSION** panel are switched on:
  a. INDICATION **: - CONTROL SYSTEM ON**
  - PROPELLER PITCH 0
  b. ALARM**: - GEAR LUB. OIL LOW PRESS.**
  - CLUTCH/SERVO OIL LOW PRESS.
  - CPP/SERVO OIL LOW PRESS.
- the following lamps on **MAIN ENGINE No 1, No 2** are switched on:
  a. INDICATION**: - CONTROL SYSTEN ON**
  b. ALARM**: - CONTROL AIR LOW PRESS.**
  - START AIR LOW PRESS.
- turning gear is in off position
- the following alarms of **SYSTEMS ALARM** are activated:
  - MAIN ENGINE No 1
  - MAIN ENGINE No 2
  - PROPULSION SYSTEM
  - COMPRESSED AIR SYSTEM

2. Check fuel oil level in service tank.
3. Open fuel oil shut-off valves before DG and after service tank.
4. Blow off-water from **DG RECEIVER**.
5. Open the start air shut-off valves on **DG RECEIVER** and before DG.
6. Open valves on suction and discharge side of **DG FW PUMPS.**
7. Open valves on suction and discharge side of **DG SW PUMPS.**
8. Switch the **DG START SELECTION** on the **MANUAL** position.
9. Start the engine with the **START** push-button.

After the start of the engine its revolutions should be at around 1000 rev/min.

Attention: In the case of faulty valves positioning of the water cooling installations, the engine stops automatically /SHUT- DOWN/ and the alarms sound. The closed valves of the air pressure will prevent starting the engine and will cause the **START AIR LOW PRESS ALARM** . The alarm should be confirmed with the **ALARM CONFIRMATION** push-button.

If, however, the fuel installation valves are not open, the engine starts but it will shut down after a few seconds /NO ALARM/. The alarms sound causes instant stopping of the engine /SHUT - DOWN/ by activating of **L.O LOW PRESS, F.W HIGH TEMP**. and **L.O HIGH TEMP**. Before the next attempt to start the engine, after the **ALARM CONFIRMATION**, the push-button **RESET AFTER SHUT- DOWN** should be pressed.

B) Starting the first generator /or after BLACK OUT/

Attention: Before starting the generator the switch **STATOR HEAT** should be **ON**, while after starting the generator on the bar it should be **OFF** /heating off /. After starting the engine the voltage indicator in the generator field will display 390 V.

1. Switch on the generator on the bars by pressing the ON push-button in the generator's field /when the generator is switched on the bars the suitable connections are visible on the **ELECTRIC DIAGRAM PANEL**/

Attention: The start of the generator on the bars is confirmed by green control lights turning on in the generator field and the synchronization block. In the synchronization block, the frequency indicator /Hz - I, voltage frequency between bars / should indicate 50 Hz. The display on the indicator II /generator's voltage frequency/ will depend on the position of the **SYNCHRONIZATION** switch.

C) The generator's synchronization procedure - automatic

1. Check whether the engine of the generator for synchronization has been started / the voltage indicator in the generator's field should display around 390 V /
2. Switch the **SYNCHRONIZATION** on the generator to be synchronized.
3. Switch the **SYNCHR. SELECTOR** on the **AUTO** position .
4. Switch on the automatic synchronization by pressing the **AUTO SYNCHR. ON** push- button.

Attention: After synchronization, the generator switched on will take over automatically 50% of the first generator's load.

D) The generator's synchronization procedure – manual

1. Check whether the engine of the generator for synchronization has been started / the voltage indicator in the generator's field should display around 390 V /
2. Switch the **SYNCHRONIZATION** on the generator to be synchronized.
3. Switch the **SYNCHR. SELECTOR** on **MANUAL** .

Attention: After selecting the manual method, the lamps **DARK MANUAL SYNCHRON.LAMP** will switch on and off with a frequency depending on the difference between the frequencies of the generator on the bars and the generator synchronized. Also the **SYNCHROSCOPE** will indicate by the rotating LED the differences in their frequencies. If the LED rotates to the right, the frequency is too fast /TOO FAST/, to the left - too slow /TOO SLOW/ The adjustment of the

appropriate frequency of the synchronized generator is operated by changing the engine speed, with the **(+ ; -) SPEED ADJUSTMENT** push-buttons.

4. A synchronized generator can be switched on the bars with the **ON** push-button, in its generator's field, in the case the synchronization lamps "dark" are completely extinguished and the LED in the synchroscope is switched on in the position marked with an arrow.

After an unsuccessful attempt of manual synchronization both the generators will turn off of the bars /BLACK - OUT/ and the whole procedure of turning on and synchronization will have to be repeated from the beginning /i.e. from the moment the first generator was started/ . After synchronization, the generator switched on will take over automatically 50% of the first one's load.

E) Unloading and switching off the generator procedure

1. Set the **SYNCHRONIZATION** switch on the position of the generator, to be switched off.
2. Start the unloading and switching off procedure by pressing the **AUTO GEN.UNLOAD. AND OFF** push-button.

Attention: The generator remaining on the bars will take over the load while the second one, after the voltage's decrease to a zero value, will switch off automatically of the bars / this generator's engine will continue running /.

F) Stopping the engine

1. Check whether the engine's generator to be stopped is switched off of the bars. The engine will stop by pressing the **STOP** push-button on the control switchboard /independently of the position of the switch **DG START SELECTION** /.

G) Engine's stand - by position /STAND-BY /

Attention: In this option, if one generator - set is working and if its engine stops or if the generator switches off, the engine in the stand-by position will be automatically started and the generator switched on the bars.

1. Switch the **DG START SELECTION** on the **AUTO** position.
2. Switch the **DG STAND BY SELECTION** on the appropriate **DG** position /selection of the engine's stand-by is confirmed by a yellow lamp **STAND - BY** in the alarms block.

5.2 Main Engines and propulsion system

Fresh water cooling system

1. Open valves on suction and discharge side of auxiliary fresh water pump (**AUX FW PUMP**) as well as on inlet and outlet part of preheater (close by-pass valve)
2. Open hot water inlet valves to selected engine to be preheated
3. Turn on **AUX FW PUMP**
4. Turn on electrical **FW PREHEATER**
5. Open indicator valves of ME prepared to start

Main engines

6. Turn on turning gear lever - **TURNING GEAR ENGAGED** alarm lamp will be activated
7. Check lubricating oil level in ME crankcase (refill oil using prelubricating pump if necessary).
8. Turn on oil **PRELUB. PUMP** (indication lamp on **MAIN ENGINE No1** or **No2** will confirm pump operation)

   Attention: Control mode of prelubricating pump set as **AUTO** means that after engine start, the pump will stop automatically (setting control mode as **MANUAL** means that pump will not stop automatically after engine start).

9. Switch on electric motor (on **GENERAL VIEW** panel)

Gear system

10. Switch on **SUPPLY** on **GEAR SYSTEM** panel
11. Switch on **SUPPLY** on **GEAR SYSTEM** panel
12. Check proper gear lubricating pump function **GEAR LUB. PUMP No 1** and **No 2** - verify pressure values
13. Turn on one of **GEAR LUB. PUMP** (No 1 or No 2)- **GEAR LUB. OIL LOW PRESS** alarm lamp will switch off. Set second pump on STAND-BY function. **STAND-BY** function operation will be confirmed by switching on of respective lamp.
14. Check proper clutch/servo oil pump function **CLUTCH/SERVO OIL PUMP No 1** and **No 2** – verify pressure values
15. Turn on one of **CLUTCH/SERVO OIL PUMP** (No 1 or No 2) - **CLUTCH/SERVO OIL LOW PRESS** alarm lamp will switch off. Set second pump on **STAND-BY** function. **STAND-BY** function operation will be confirmed by switching on of respective lamp.
16. Check proper gear auxiliary lubricating pump function **AUX LUB OIL PUMP** through **MANUAL** operation (press push-button **START**) – verify pressure value. Next, set the control mode of this pump on **AUTO** (at this setting **AUX LUB OIL PUMP** will turn on automatically at low oil level in gravity tank and turn off at max. oil level.

In case the **AUX LUB OIL PUMP** is set as **MANUAL**, the pump after turning on will operate continuously and oil will overflow to main tank

C.P.P. System

17. Switch on **SUPPLY** on **CPP SYSTEM** panel
18. Set switch Pump operation of the Main pump aggregates into position **I - local control**
19. Check proper controllable pitch propeller pumps function **CPP/SERVO PUMP No 1** and **No 2** – verify pressure values
20. Turn on one of **CPP/SERVO OIL PUMP** (No 1 or No 2) - **CPP/SERVO OIL LOW PRESS** alarm lamp will switch off. Set second pump on **STAND-BY** function.
21. Check proper CPP auxiliary lubricating pump function **CPP LUB OIL PUMP** by **MANUAL** operation (press push-button **START**) – verify pressure value. Next, set the control mode of this pump on **AUTO** (at this setting **CPP LUB OIL PUMP** will turn on automatically at low oil level in gravity tank and turn off at max. oil level).
    In case **CPP LUB OIL PUMP** is set as **MANUAL**, the pump after turning on will operate continuously and oil will overflow to main tank
22. After **GEAR LUB. PUMP, CLUTCH/SERVO OIL PUMP** and **CPP/SERVO OIL PUMP** turning on, **PROPULSION SYSTEM** alarm lamp will switch off on SYSTEMS ALARM panel
23. Check CPP mechanism function through revolution/pitch control lever setting **AHEAD** and **ASTERN** (observe **PITCH** gauge indication)

Compressed Air System

24. Open **ME COMPRESSOR** supply valves to **ME AIR RECEIVER**
25. Switch on **ME COMPRESSOR** manually, then set compressor control mode as **AUTO**
26. Blow-off water from ME **AIR RECEIVER**
27. Open the valves of control air supply system (**CONTROL AIR LOW PRESS**. alarm lamps should turn off on ME No 1 and No 2 panels)
28. Open the start air shut-off valves on **ME AIR RECEIVER** and before ME (**START AIR LOW PRESS** alarm lamps will switch off on ME No1 and 2 panels)

    Attention: After **CONTROL AIR LOW PRESS** and **START AIR LOW PRESS** alarm lamps switch off, **COMPRESSED AIR SYSTEM** alarm on **SYSTEMS ALARM** panel will switch off as well

Fuel oil system

29. Check fuel oil level in service tank. (Refill fuel oil using centrifuge if necessary).
30. Open fuel oil shut-off valve before ME (from service tank)
31. Direct fuel oil overflow from injection pumps to service tank through proper (two-way) valves positioning

Sea water cooling system

32. Open valves on suction and discharge side of **AUX SW PUMP**
33. Directly before ME (or engines) start, open inlet valve on suction side of **ME SW** pump connected with auxiliary sea water pump and switch on **AUX SW PUMP**

Main Engines

34. Switch off turning gear (or gears) electric motor
35. Turn off the lever of turning gear (**TURNING GEAR ENGAGED** alarm lamp for adequate engine as well as MAIN ENGINE No 1 or 2 alarm lamps on SYSTEMS ALARM panel will switch off)

36. Close indicator's valves
37. After aprox. 4 minutes as of prelubricating pump turning on, the indication lamp **ENGINE READY FOR START** will be switched on.

    Attention: Before ME start, the fresh water temperature on engine outlet should be min. 40 °C

38. Set potentiometer **RPM CONTROL** on **IDLE** value
39. Set potentiometer **LOAD ADJUSTMENT** on **0** position
40. Set revolution/pitch control lever on **0** position .Check whether indication lamp **PROPELLER PITCH 0** is switched on
41. Start selected ME by pressing push-button **MAIN ENGINE – START**
42. After ME start, check **LUB OIL**, fuel oil, fresh water as well as sea water pressures
43. Turn off **AUX SW PUMP**.
44. Close discharge valve from **AUX SW PUMP** to **ME SW** pump
45. After aprox. 2 minutes time, the indication lamp **ENGINE READY FOR CLUTCH** will switch on
46. Engage ME by pressing push-button **CLUTCH - ON**
47. Set revolution/pitch control lever on demanded value

    Attention: In case the control lever dislocation is too quick, propeller pitch blockage may occur (from **0** till max. **AHEAD** or **ASTERN** value a minimum 20 sec. time is required)

48. It is necessary to finalize the following procedure to start the second engine (first one is already engaged):

    a. start ME by pressing push-button **MAIN ENGINE – START**
    b. set the ME (that is prepared to clutch) revolution using **RPM CONTROL** potentiometer (with a tolerance of +/- 20 RPM) in accordance with the first engine revolution value.

       Attention: Potentiometer **RPM CONTROL** is active only in case the first ME is already engaged.

    c. engage second ME by pressing push-button **CLUTCH – ON**

       Attention: The difference between revolution values of both ME (during second engine engagement procedure) that is higher than 200 rev./min. will cause clutch mechanism damage (after clutch mechanism damage, the revolution of the ME that was ready to clutch, will remain the same as before the failed engagement procedure)

49. Before ME disengagement (at both ME running) set **RPM CONTROL** potentiometer on **IDLE** position

    Attention: Revolution/pitch control lever should be set below the value of 5.0 before ME disengagement.

5.3 Propulsion system emergency local operation

5.3.1 Main engine No 1 local starting procedure

Attention: Before ME local start all the auxiliary systems (cooling systems, lubricating oil system, fuel oil system etc.) have to be prepared in the same way as in normal operation mode. This means that all the procedures from paragraph 5.2 have to be accomplished.

1. Set control mode to local by pressing **Local** push button on console
2. Start ME No 1 by pressing push-button **MAIN ENGINE – START** on Main Engine No 1 local control panel

5.3.2 Gear system local clutch procedure

Attention: All the conditions for manual clutching the engine are identical with the remote clutching procedure. All the systems and pumps have to be started before local clutching.

1. Clutch ME No 1 by pressing push-button in ME No 1 clutch manual control.

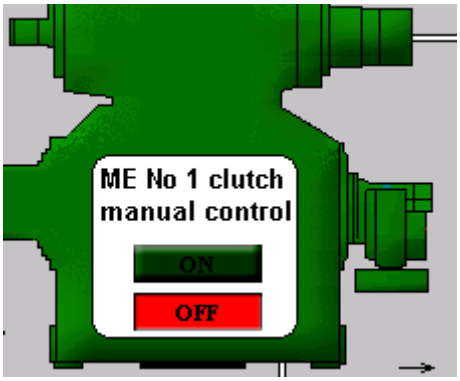


Fig. 5.1 Clutch manual control push-button

5.3.3 C.P.P. system starting procedure

Attention: After programme starting, two alarm lamps turn on : Servo oil low pressure and Control oil low pressure, and the alarm signal simultaneously turns on. After pressing the push-button alarm confirmation the alarm signal switches off.

1. Basic operation mode

At basic operation mode with remote control the following operations should be performed:

a) open the shut-off valve at the installation diagram
b) on local control panel set up the three – position switch **Pump Operation** into position **II** – remote control.
c) on Pump Aggregate control panel :
   - set up the three-position switch **Pump Operation** of all Pump Aggregates into Position **I – Manual**
   - switch on supply of all pump aggregates - set up two-position switches into position **I** – supply activation will be confirmed by turning on of the **Supply**

lamps. After turning on the supply, in each of the pump aggregates' fields, **Remote** lamps will turn on confirming remote control mode.

- Switch on **CPP/SERVO PUMP** by pressing the push-button **Start** (the lamp **Pump run** will turn on and simultaneously the alarm lamps **Servo oil low pressure** and **Control oil low pressure** will switch off).
- Set up the second **CPP/SERVO PUMP** on stand –by mode by setting the switch **Pump operation** into position **II- auto**. Stand-by operation mode of the second **CPP/SERVO PUMP** will be confirmed by turning on the **St-by** lamp. This means that in the event of lack of discharge oil pressure of **CPP/SERVO PUMP No 1** pump No 2 will automatically turn on.
- On Lubricating pump aggregate block set switch **Pump operation** into position **II – auto** control. This means that, depending on the oil level in the gravity tank, the Lubricating pump aggregate will turn on and off. Lubricating pump aggregate will turn on at minimum oil level MIN and will turn off at maximum oil level MAX.

d) Pitch propeller remote control mode may be set up as <u>follow-up control</u> by setting control lever on console. Once the follow – up mode is set, it is possible to adjust the propeller pitch by mouse clicking on the arrow field **AHEAD** - marked with green colour on lever's scale or **ASTERN** - marked with red colour on lever's scale .

2. Emergency operation mode (in case of control signal from bridge failure)

At emergency operation mode when one of the Main pump aggregates functions and the control mode is local, the following operations have to be carried out :

a) on control panel:
   - set three-position switch **Pump operation** of CPP/SERVO PUMP into position **0 - off**
   - turn on supply of the Main pump aggregates. After turning on the supply on the fields of Main pump aggregate, the **Supply** lamp will turn on.

b) on local control panel set switch **Pump operation** of the Main pump aggregates into position **I - local** control.

<u>*Attention*</u>: Setting the whole remote control mode as manual means that remote control from the bridge and from Console does not function. In real conditions on board, in order to set the operation mode as local it is necessary to use a separate independent switch placed on the Local Control Panel.
At this operation mode it is also not possible to turn on **CPP/SERVO PUMP** on control panel.

c) on local control panel, start chosen Main pump aggregate by pressing push button **Start.**

d) local control of pitch propeller adjustment is done by acting manually on local pitch control lever.

Fig. 5.2 Local pitch control lever

Attention: At emergency local control mode it is necessary to observe the **PITCH** gauge in order not to exceed the maximum pitch value determined during sea trials as nominal value, as otherwise it will lead to ME overload.

3. Emergency control mode (in case of a failure of Main pump aggregates)

At emergency control mode (in case of a failure of Main pump aggregates) when the Lubricating pump aggregate functions and the control mode is local, the following operations have to be carried out:

a) on control panel
- switch off the Main pump aggregates' supply
- in the fields of Main pump aggregates set three-position switch **Pump operation** into position **0 – off**

b) on local control panel :
- set three – position switches **Pump operation** of both Main pump aggregates into position **0 – off**
- set switch **Pump operation** of the Main pump aggregates into position **I- local** control
- start lubricating pump aggregate by pressing push button **START**

c) on the installation diagram :
- close shut-off valve
- set manual two – position distribution valve for emergency oil distribution block supply (by mouse clicking on field of valve lever) Fig. 5.3
- connect emergency quick connecting valve with connecting hose (by mouse clicking on field of oil distribution box connecting hose Fig.5.3

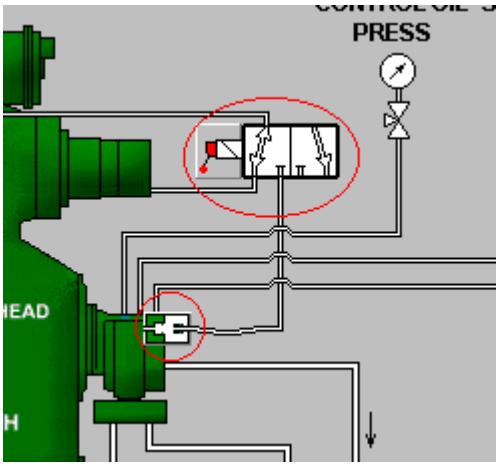


Fig. 5.3

Emergency control of pitch propeller (only **AHEAD**) is possible by turning on Lubricating pump aggregate, by pressing **Start** push button on local control panel. Once the demanded propeller adjustment is achieved (only **AHEAD**), Lubricating pump aggregate has to be stopped. As a next step, manual two -position distribution valve has to be set, as for normal lubrication operation (by mouse clicking on field of valve lever) and Lubricating pump aggregate has to be turned on again on local control panel. At emergency operation mode of this type, shut-off valve remains closed in order to improve the conditions of lubrication and cooling of oil distribution box.

Attention :
In case of servo oil supply system failure of Main pump aggregates, automatic blockage of pitch propeller occurs. Such state allows for further emergency operation of pitch propeller, at previously set adjustment (it is not necessary to change pitch propeller adjustment by applying the emergency mode described above). In this situation, it is only necessary to turn on Lubricating pump aggregate into continuous operation and to close shut-off valve in order to improve the conditions of lubrication and cooling of oil distribution box.

It is also possible to set the pitch propeller at emergency mode **AHEAD** in case of failure of all pump aggregates. This is done by means of an additional, manually operated pump. This situation is not simulated within the program. The pitch propeller manufacturer also enabled emergency pitch propeller operation by means of emergency oil supply from Lubricating pump aggregate directly to valve block BZ. This possibility is not simulated within the program.

5.3.4 C.P.P. system stopping procedure

Stopping procedure of pitch propeller installation once the manoeuvres are finished (during stay in ports) requires the performance of the following tasks:

a) on control panel:
   - set switch **CPP/SERVO PUMP st-by sel.** into position **0- off** - **St-by** lamp of pump aggregate being on stand by mode turns off.
   - switch off working **CPP/SERVO PUMP** by pressing **Stop** push button and set switch **Pump operation** into position **0- off**
   - switch off Main pump aggregates **supply**

- Lubricating pump aggregate supply should remain turned on and **Pump operation** switch should be in position **II - Auto**.

b) on installation diagram check whether shut-off valve is open.

5.4 Reverse osmosis desalination system

5.4.1 Starting Procedure

1. Close all System Drain and Air Bleed Valves.
2. Open the Inlet Sea Cock Valve.
3. Position the Booster Pump Feed Source Directional Control Valve to the normal feed water operational position (should connect inlet pump witch sea water supply source).
4. Open the Back Pressure Regulator Valve fully (100% open).
5. Position the Brine Discharge Directional Control Valve to the normal operation position (from the Back Pressure Regulator Valve to the Overboard Connection).
6. Open any and all auxiliary line valves leading to and from the Sea Recovery R.O. System.

CAUTION: Failure to open all lines to and from the Sea Recovery System will result in immediate damage to the Sea Recovery System at start up.

7. If the System is started for the first time or after aeration you have to:
   - **a)** Open the Air Bleed Valve located at the left side of the respective filter housing.
   - **b)** Switch the Booster Pump control switch to the **MANU** position which will start the Booster Pump until water displaces all of the air.
   - **c)** Switch the Booster Pump control switch to the **OFF** position.

*CAUTION: In the **Manu** position the Booster Pump is controlled independently of the High Pressure Pump. In the **Auto** position the Booster Pump is started and stopped automatically with the High Pressure.*

8. Switch the Booster Pump control switch to the **AUTO** position - this will cause the Booster Pump to start automatically when the system is started.
9. Press the System **START** switch.

If the Low Pressure Gauge 31 registers below 0.1 MPa the Low Pressure Protection Switch will automatically stop the System.

10. If Feed Water Pressure increases to above 0.1 MPa the System should be running and water will be passing through the Feed Water Flow Meter. Any air passing through the meter will cause incorrect reading.
11. When feed water flow will be proper about 40 l/min, slowly increase the pressure in the system (after high pressure pump) by turning the Back Pressure Regulator Valve until pressure of 4.2 MPa is achieved.
12. With 4.2 MPa operating pressure, the System will pass Feed Water through the R.O. Membrane Element. With applied 4.2 MPa pressure Feed Water will continue passing through the membrane and on into the Produced Water Flow Directional Valve, and back to the Feed Source.

13. Continue adjusting the Back Pressure Regulator Valve slowly until pressure reaches 5.2 to 5.6 MPa. Do not operate the system above 6 MPa.
14. The system running, properly interconnected and pressurized, may not produce "Potable" Produced Water for up to 30 minutes after start.

5.4.2 Shutdown Procedure

1. Release the operating pressure in the System by turning the Back Pressure Regulator fully open (100% open).
2. Press the **STOP** switch on the Salinity Controller to Shut Down the System.
3. Immediately after stopping the System, close the Inlet Sea Cock Valve.
4. Refer to **STORAGE & CLEANING PROCEDURE**

5.4.3 Storage & cleaning procedure

Short term shutdown

1. Close the Inlet Sea Cock Valve .
2. Position the Booster Pump Feed Source Directional Control Valve to the rinse position (should connect inlet pump with Cleaning Tank).
3. Position the Brine Discharge Directional Control Valve to the normal operation position (from the Back Pressure Regulator Valve to the Overboard Connection).
4. Open the Back Pressure Regulator Valve fully.
5. Fill the Cleaning Tank full with potable water from hydrophore.
6. Place the Booster Pump switch in the **AUTO** position.
7. Start the System by pressing the System **START** switch.
8. After the rinse tank is empty or after sufficient rinse water has entered the system, stop the rinse cycle by pressing the System **STOP** switch.
9. Position the Booster Pump Feed Source Directional Control Valve to the normal operation position.

Long term shutdown

1. Close the Inlet Sea Cock Valve.
2. Position the Booster Pump Feed Source Directional Control Valve to the rinse position (should connect inlet pump with Cleaning Tank).
3. Position the Brine Discharge Directional Control Valve to the normal operation position (from the Back Pressure Regulator Valve to the Overboard Connection).
4. Open the Back Pressure Regulator Valve fully.
5. Fill the Cleaning Tank full with potable water from hydrophore.
6. Place the Booster Pump switch in the **AUTO** position.
7. Start the System by pressing the System **START** switch.
8. After the rinse tank is empty or after sufficient rinse water has entered the system, stop the rinse cycle by pressing the System **STOP** switch.
   Note. The System has now been rinsed with fresh water and is ready for storage chemical solution closed loop circulation.
9. Position the Brine Discharge Directional Control Valve to the Cleaning Storage Tank return.

10. Fill the Cleaning Tank with potable water, add chemicals to the water by opening valve from Chemical Tank.
11. Start the System by pressing the System **START** switch.
12. The System is now recirculating storage chemical solution.
13. Stop the System by pressing the **STOP** switch.
14. Position the Brine Discharge Directional Control Valve to the normal operation position (from the Back Pressure Regulator Valve to the Overboard Connection).
15. Start the System by pressing the System **START** switch.
16. Continue to operate the system until all of the storage solution has been discharged from the Cleaning Tank.
17. Once the storage Cleaning Tank is empty, stop the System by pressing **STOP** switch.

5.4.4 Filter's cleaning procedure

1. If the System is running you have to:
   a) Release the operating pressure in the System by turning the Back Pressure Regulator fully open (100% open).
   b) Press the **STOP** switch on the Salinity Controller to Shut Down the System. Check to ensure that the High Pressure Pump and the Booster Pump have stopped rotating.
2. Close the Inlet Sea Cock Valve.
3. Press the **Clean** button located under the respective filter.

5.5 Oily water separator

5.5.1 Preparation for starting the plant

1. Open valve from bilge tank, to waste tank and fresh water supply and to oil concentration alarm tank
2. Switch **Control mode** on **II - Auto**
3. Switch **Heater** on **0 - Off**
4. Switch **Manual control** on **0 - Off**
5. Set **Main switch** on **I** . The following signal lamp shall now light:
   - **Supply**
   - „**Alarm oil level**
   - **Alarm oil level - outlet**

   Push the button **Alarm confirmation**
6. Fill up the chambers with water by pressing push-button **Reset**. For filling up both sea water and fresh water can be used. The filling-up procedure ends when water reaches the level of upper oil probe 15.

5.5.2 Starting the plant

1. Press again push-button **Reset** for plant starting. Solenoid valve opens and water pump starts - separation process begins.
2. The heater needs only to be switched on when very heavy oils are in the unit, being difficult and slow to discharge.

5.5.3 Manual control

Changing over the plant operation into manual control mode is made by setting the switch **Control mode** into position **I – Manual**.
In the manual control mode the following actions can be actuated:
a) Water discharging by setting switch **Manual control** in **I -Water pump**;: position
b) Oil discharging by setting switch **Manual control** in **II – Oil/water solenoids** position.

5.6 Refrigerating system

5.6.1 Starting procedure

1. Open all necessary valves.
2. Open shut-off valve placed at suction compressor line with six positions possible by mouse clicking in the arrow field in **0** direction.
3. Turn on the main switch (point and click with the mouse in the proximity of **ON**. Switching on is confirmed by a green lamp **START**. If temperature in chambers is higher than the setting temperatures on the proper thermostat then the green lamps **START** of the fans and the solenoid valves shall light, indicating their activity.
4. Switch on the condenser cooling water pump (point and click with the mouse in the proximity of **ON**). Switching on is confirmed by green lamp **START**.
5. Start the compressor (point and click with the mouse in the proximity of **ON**) The yellow lamp **STAND BY** indicates that the compressor is ready to work. At the same time the blue lamp **OIL HEATER** lights indicating that lubricating oil in the compressor crankcase is heated. The compressor starts (the green lamp **START** turns on while the lamp **OIL HEATER** turns off) when suction pressure p_s, (shown in display) increases above the setting pressure at the low pressure safety cut-out LPC Fig. 5.4. The compressor stops when the suction pressure will be lower than stop compressor pressure set on LPC. START - DIFF = STOP.
6. After switching on the compressor by setting switch at **ON** position, open outlet valve from shell and coil condenser.

Attention:
The compressor capacity is automatically regulated on the level of 50 or 100%. The compressor load indicator is located in the upper part of the compressor. It depends on the number of the working cold chambers /two green lights indicate that two chambers are in service -compressor capacity 100%, one green light indicates that one chamber is in service - compressor capacity 50% /.

1. If shut-off valve placed at suction compressor line is not opened, the compressor starts and works till suction pressure p_s decreases to a level lower than the pressure set at the low pressure safety cut-out LPC. When the suction pressure reaches this level, the compressor is automatically stopped. The compressor starts again when the suction pressure increases higher than the value set at the LPC.
2. If shut-off valve before shell and coil condenser is not opened Fig. 4.45, the compressor starts and will work until compression pressure p_t becomes higher than the pressure set at the high pressure safety cut-out HPC. Then the compressor stops and the red alarm lamp **EMERG. STOP HIGH PRESS** turns on and the alarm sounds. In order to repeat the compressor start it is necessary to open valve 1 and wait until pressure decreases to about 1,4 MPa. Then it is necessary to reset the high pressure safety cut-out HPC by mouse

clicking the button **RESET** on HPC diagram Fig.5.5. When pressure set at the HPC exceeds 2,1 MPa (in case of excessive pressure), the safety valve **SV** acts (the valves field lights red), connecting the compressor suction and compression sides. If the compression pressure p_t decreases to the value about 1,4 MPa, then by mouse clicking press the button **RESET** placed over the safety valve in order to unlock it.

3. If outlet valve from shell and coil condenser is not opened the compressor starts and will work until all refrigerant vapour from the chamber evaporators is sucked off and suction pressure p_s decreases below the pressure set at the low pressure safety cut-out LPC. The compressor starts automatically when suction pressure increases over the value set at the LPC Fig. 5.4.
4. If condenser cooling water pump is off, the compressor starts and works until an increase of the condensing pressure p_k occurs and consequently the compression pressure p_t increases over the value set at the high pressure safety cut-out HPC. The high pressure alarm lamp **EMERG. STOP HIGH PRESS** turns on and the alarm sounds. It will be possible to repeat the compressor start only after the pressure decreases to the value of about 1,4 MPa, by pressing the button **RESET** on HPC diagram Fig.5.5.
5. During normal exploitation, the condenser is cooled by the pressure - controlled valve 8 Fig. 4.45. The condenser cooling water flow is regulated by means of by pass valve 7 (by pass valve with 4 positions possible). Mouse clicking in the arrow field in **0** direction increases the condensing temperature t_k, condensing pressure p_k and condenser cooling water temperature t_{w2}, while clicking in direction **s** decreases these parameters.
6. If the pressure difference in the compressor lubricated oil system is lower than the difference set on the differential pressure control DPC (0,03 MPa), the compressor starts and stops immediately (time delay - about 3 sec). On the control panel **EMERG. STOP OIL LOW PRESS** lamp turns on and the alarm sounds.
7. It is possible to check the functioning of the differential pressure control DPC by mouse clicking on the button **TEST** (placed on the diagram, over DPC Fig. 5.6). The compressor should stop and start after **TEST** button release.
8. The push - button **LAMPS TEST** serves to check the proper functioning of the control lamps.

5.6.2 Continuous running procedure

After starting the refrigerating plant according to the procedure described above, the refrigerating plant works in an automatic cycle. The chamber temperatures decrease gradually until temperatures reach values set at the proper thermostat. Then the solenoid valve is automatically closed (valve SV 1 or SV 2 changes colours) and fans are switched off. After standing period, when temperature in the particular cold chamber rises over the value set on the thermostat, the solenoid valve opens automatically (the valve SV 1 or SV 2 changes colours) and fan turns on.

The following parameters:
- suction pressure p_s,
- suction line temperature t_s,
- compression temperature t_t,
- compression pressure p_t,
- condensing temperature t_k,
- condensing pressure p_k,

are continually changing, (this depends on the cold chambers temperature and number of the chambers being in service). The values of these parameters are shown as corresponding displays on diagram.

Attention:

1. If shut-off valve placed at suction compressor line is closed Fig. 4.45, after a few seconds the low pressure safety cut-out stops the compressor. When suction line pressure increases over the value set on the LPC Fig. 5.4 the compressor starts automatically.
2. During compressor standing, in the event the temperature in chambers increases over the set temperature on TER Fig. 5.7, thermostat causes the solenoid valve opening and the fan switches on.
3. If shut-off valve before shell and coil condenser is closed Fig. 4.45 after a few seconds the compressor stops due to the increasing compression pressure over the value set on the high pressure safety cut-out. The high pressure alarm lamp **EMERG. STOP HIGH PRESS** turns on and the alarm sounds. It will be possible to repeat the compressor start only after the pressure decreases to the value of about 1,4 MPa, by pressing the button **RESET** on HPC diagram Fig. 5.5.
4. If outlet valve from shell and coil condenser is closed the compressor stops after suction pressure decreases below the value set on the low pressure safety cut-out LPC. The temperature in the chambers slowly rises. The compressor starts automatically when suction pressure increases over the value set on the LPC Fig. 5.4.
5. The back pressure regulator BPR is set at a constant evaporator pressure in the chamber 2 corresponding to this chamber temperature level of 10 °C.

5.6.4 Stopping procedure

1. Close outlet valve from shell and coil condenser on the installation diagram.
2. Wait until the compressor sucks off the refrigerant vapour from the installation and stops automatically (when the suction line pressure is lower than pressure set on low pressure safety cut-out LPC).
3. Suction pressure, notwithstanding that the outlet valve from shell and coil condenser is closed, increases after a few minutes up to a value that makes possible the compressor start.
4. The compressor sucks off the rest of the refrigerant vapour from installation and automatically stops.
5. After compressor stopping, close all valves.
6. Switch off the compressor by mouse clicking in the proximity of **OFF** on **COMPRESSOR** switch on the control panel. The lamps **STAND BY** and **OIL HEATER** turn off.
7. Switch off the condenser cooling water pump by mouse clicking in the proximity of **OFF** on **CONDENSER COOLING PUMP** switch (lamp **START** turns off).
8. Turn off the main switch by mouse clicking in the proximity of **OFF** on **MAIN SWITCH** on the control panel.(**START** lamp turns off as well as the ventilators and solenoids **START** lamps).

5.6.5 Cold chamber 1 defrosting procedure

Defrosting is realised in deep refrigeration chamber 1. Defrosting is effectuated by using electric heaters. It may be carried out in automatic or manual cycle. The thermostat placed on the lowest evaporator coil signalises when defrosting ends. The thermostat setting is constant,

without a possibility of external changes. Defrosting takes place when temperature in the chamber 1 is below 0°C.

Automatic defrosting:
1. Set the defrosting timer on control panel in order to determine defrosting frequency. This operation can be realised each 8 min. (timer set on 8), each 16 min. (timer set on 16) or each 24 min (timer set on 24).
2. After a period of time 8, 16 or 24 min. (according to the frequency set) the yellow lamp **DEFROSTING START** turns on and subsequently the lamp **START** of the solenoid valve and the fan in chamber 1 switch off. Next, the lamp **EVAP. HEATER ON** turns on.
3. During defrosting operation, the chamber 1 temperature display turns red, indicating that defrosting proceeds.
4. When defrosting procedure is finished, the lamp **EVAP. HEATER ON** turns off automatically and next, the lamp **START** of the solenoid valve and the fan turn on.
5. Chamber 1 temperature display changes colours from red to blue.

Manual defrosting:
1. Press push- button **MANUAL DEFROST.** on the control panel (by mouse clicking).
2. The yellow lamp **DEFROSTING START** turns on and the lamp **START** of the solenoid valve and the fan in the chamber 1 switch off simultaneously. Next, the lamp **EVAP**. **HEATER ON** turns on.
3. During defrosting operation, the chamber 1 temperature display turns red, indicating that defrosting proceeds.
4. When defrosting procedure is finished, the lamp **EVAP**. **HEATER ON** turns off automatically and next, the lamp **START** of the solenoid valve and the fan turn on.
5. Chamber 1 temperature display changes colours from red to blue.

Attention:
1. During defrosting procedure **EVAP. HEATER ON** the solenoid valve of chamber 1 is closed (the fan is off, the temperature in the chamber slowly rises).
2. During defrosting chamber 1, chamber 2 maintains normal automatic operation.

5.6.6 Low suction pressure (p_s) setting procedure

Suction pressure which makes the compressor stop is set on the low pressure safety cut-out LPC. The start compressor pressure values **START** are marked on the right side of the LPC scale. This pressure setting is realised by mouse clicking on the adjustment screw arrow field (on the right side).The values of the difference between compressor start pressure and compressor stop pressure **DIFF** are marked on the scale on the left side of the LPC Fig. 5.4. This difference can be adjusted by mouse clicking in the difference adjustment tap arrow field (on the left side). Stop compressor pressure **STOP** equals to the difference between start compressor pressure **START** and differential **DIFF** set in on the LPT scale.
STOP = START - DIFF
The pressure gauge placed close to LPT illustrates the dependence between the refrigerating medium R 22 evaporator temperature and the current evaporating pressure.

Attention:
1. Low pressure safety cut-out LPC Fig. 5.4 diagram is opened by mouse clicking at LPC symbol field placed on the installation diagram. After adjustment, close the LPC zoom

2. Compressor stopping pressure should be set on such level as to obtain demanded temperature in chambers. For this purpose, it is necessary to set pressure on LPC Fig. 5.4 corresponding to the demanded temperature in chamber 1 but decreased by the temperature difference necessary for the heat exchange process. For example, if this temperature is about 8°C and the evaporating temperature read from pressure gauge is -10°C, then the lowest temperature possible to obtain in the chamber is equal to –2°C.

5.6.7 Maximum compression pressure (p_t) setting procedure

The maximum admissible compression pressure is set on the high pressure safety cut-out HPC. The values of pressure are marked on the HPC scale Fig.5.5. The maximum compression pressure can be set by mouse clicking in the arrow field (close to adjustment screw).

Attention:

1. The button **RESET** will be active (it will unlock HPC) when compression pressure drops to 1,4 MPa.
2. In the program HPC is set at the compression pressure value recommended for refrigerating medium R 22 i.e. 1,8 MPa.
3. High pressure safety cut-out HPC diagram is opened by mouse clicking at HPC symbol field placed on the installation diagram. After adjustment, close HPC zoom Fig. 5.5.

5.6.8 Differential pressure control DPC setting procedure

The difference between the oil pump compression pressure and compressor suction pressure is set by mouse clicking in the arrow field on DPC scale Fig. 5.6. In order to check whether the DPC is properly functioning, press the button **TEST** over DPC symbol, while the compressor is running. The compressor stops for a while, but after releasing the button **TEST** it starts again.

Attention:

When setting pressure difference is inferior to 0,03 MPa, the compressor stops automatically after approximately 3 seconds.

5.6.9 Cold chamber temperature setting procedure

The value of the demanded temperature in the chamber is set on the chamber's thermostats. The temperature values are marked on the thermostat scale. The choice of a demanded temperature is done by mouse clicking in the arrow field in the upper part of thermostat. The scale of admissible temperature difference **DIFF** - between actual temperature in the chamber and the set temperature - is placed in the down part of the thermostat. The difference of temperature adjustment is effectuated by mouse clicking in the arrow field placed under the temperature difference scale. The auxiliary diagram (helpful for proper temperature difference adjustment), is situated close to the thermostat. The temperature scale set on the thermostat is presented on the left side of the auxiliary diagram. The scale of values describing the temperature drop in the chamber is presented on the right side. The determined values describing the above difference are presented in the form of an angular line scale placed between left and right scale. The proper value to be set on the thermostat difference temperature scale **DIFF** is obtained by crossing the lines connecting left and right scale with the central one.

Example:
The temperature set on the thermostat is equal to 10°C. By mouse clicking on the diagram field, the line connecting the scale on the left side with the scale on the right, appears. In our example the line begins at the value of 10°C on the left scale. If we decide that the temperature decrease in the chamber will be equal to 2°C, in relation to the temperature set on thermostat, then we ought, by mouse clicking, to set the value of 2°C on right side of the diagram scale (the fan and the solenoid valve turn off at the temperature of 10 - 2 = 8°C). The numerical value on the scale in the middle of the diagram (in the described case equal to 4,5) is obtained by crossing the middle line with the lines connecting numbers 10 (left side scale) and 2 (right side scale). The obtained value should be set by mouse clicking on the arrows field below difference scale **DIFF**.

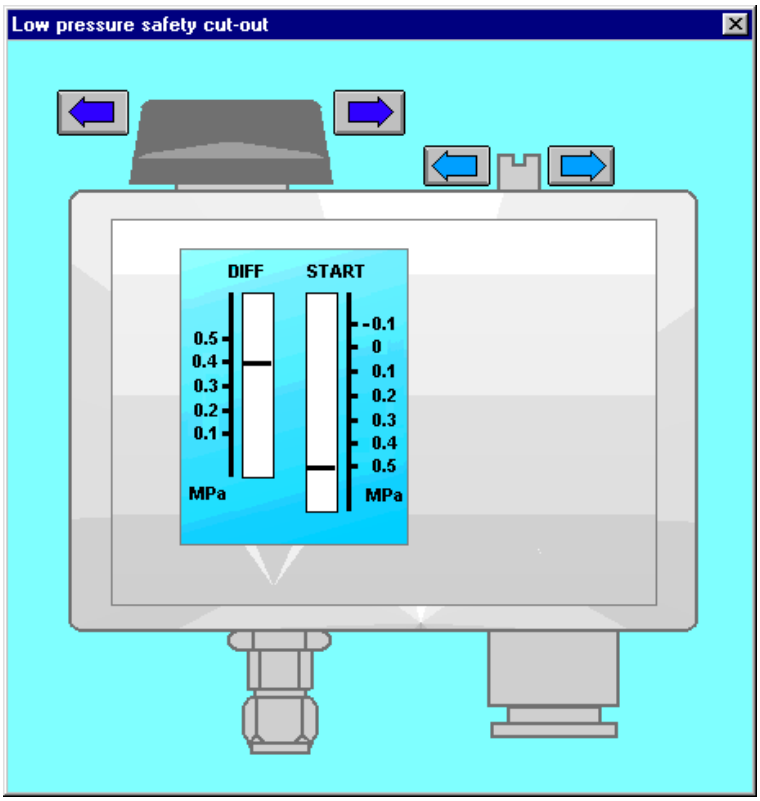


Fig. 5.4 Low pressure safety cut-out diagram /LPC/

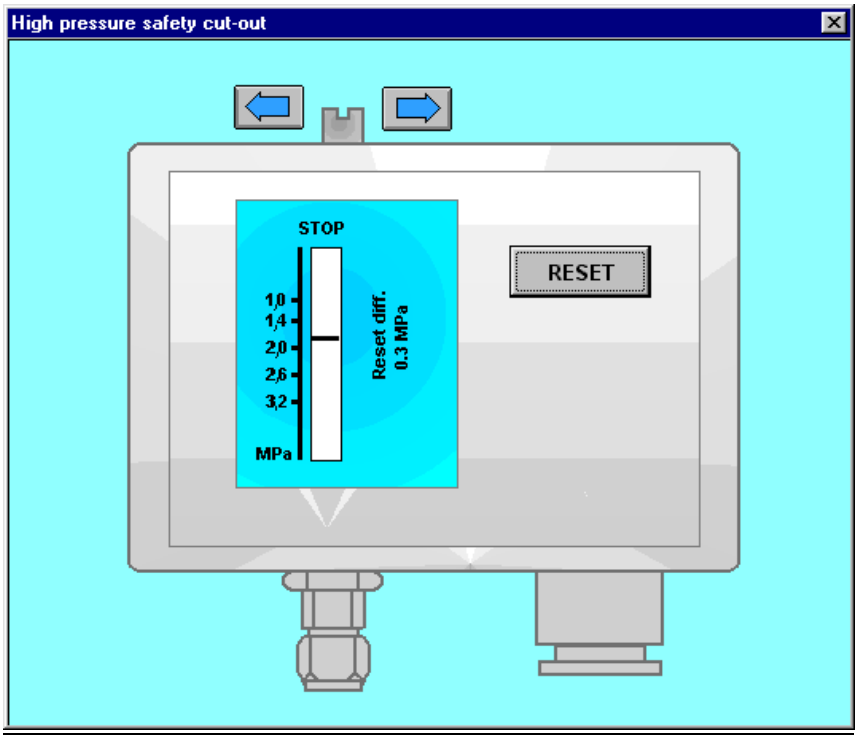


Fig. 5.5 High pressure safety cut-out diagram /HPC/

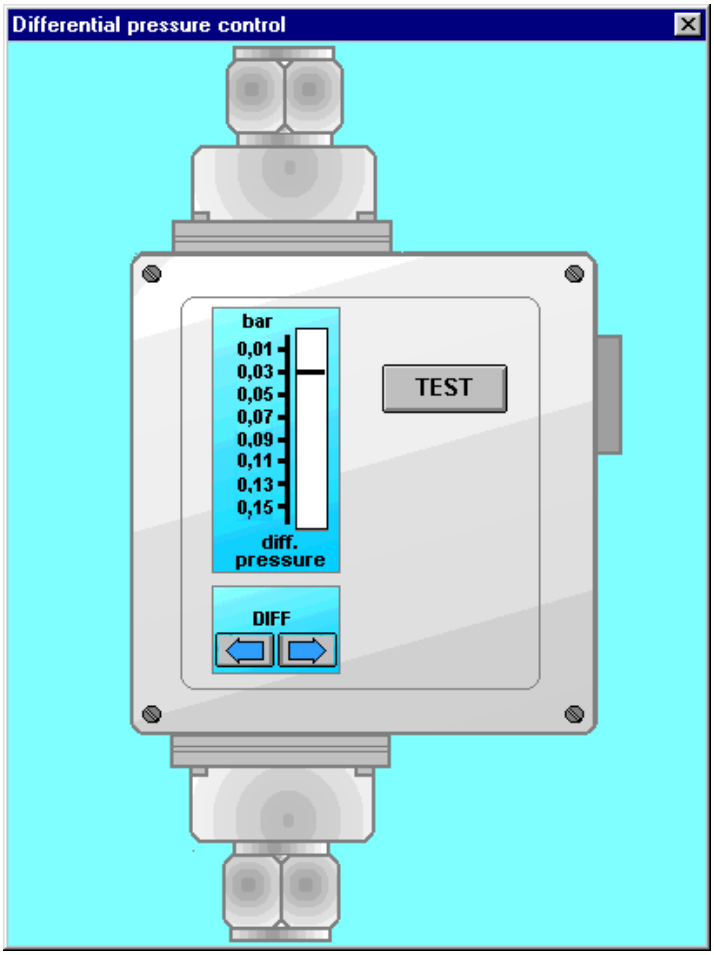


Fig. 5.6 Differential pressure control diagram /DPC/

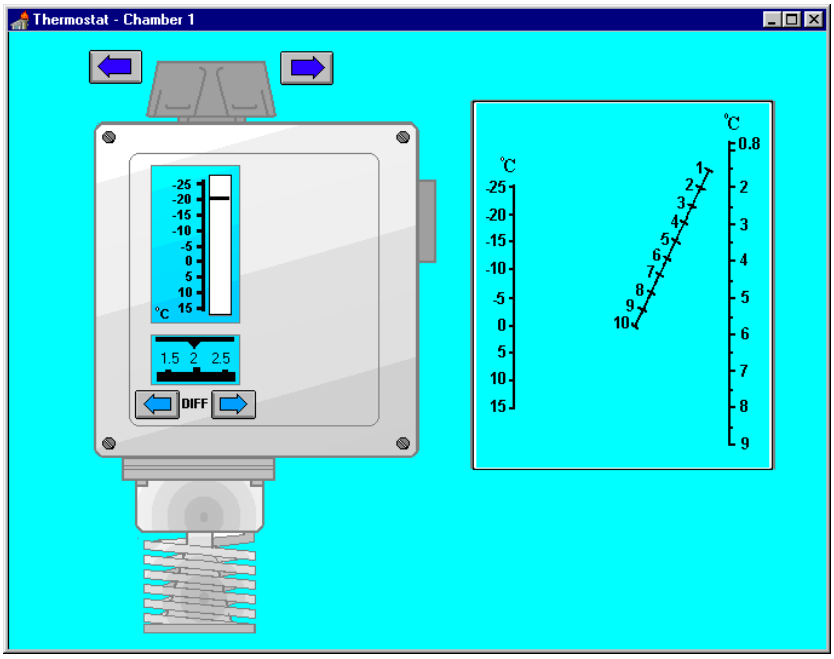


Fig. 5.7 Thermostat diagram /TER/

5.7 Steering gear installation

5.7.1 Starting procedure

Switching on the steering gear for basic operation consists in switching any electric motor of the drive unit. In case the drive unit 1 is working for instance, the drive unit 2 should be on **stand-by** mode (push the button **stand-by** at the field of the drive unit 2 of the bridge control panel). This enables the functioning of the automatic system - in the event that any default occurs in the working drive unit, the drive unit in the **stand-by** mode shall start working automatically). This state of steering gear controlling is called **coupled work** and it is optimal from the operational and safety point of view.

To put the steering gear into service the following duties should be performed:

- at the power switchboard of the drive unit 1:

1. Set up the **Main switch** into position **I** (the white lamp **Supply** lights up),
2. Set up **Pump operation** switch into position **II** (**Remote operation),**
3. Turn on **Remote control disconnection** switch into position **0**,
4. Switch **Fan operation** into position **I,**

- at the power switchboard of the drive unit 2:

6. Set up the **Main switch** into position **I** (the white lamp **Supply** lights up),
7. Set up **Pump operation** switch into position **II (Remote operation),**
8. Turn on **Remote control disconnection** switch into position **0,**
9. Switch **Fan operation** into position **I,**
10. Push the button **Stand-by** (the button lights up in blue colour).

Local steering gear starting procedure is shown below:

In this case the steering gear performs a basic operation by means of control levers of the solenoid control slide valve. This kind of steering gear switching on mode is used during the acceptance tests, overhauls or emergency situations. In order to put steering gear into operation, it is necessary:

- at the power switchboard of any drive unit :

1. Set up the **Main switch** into position **I** (the white lamp **Supply** lights up),
2. Turn on **Pump operation** switch into position **I (Local operation),**
3. Set up **Remote control disconnection** switch into position **I.**

5.7.2 Short-term stopping procedure (steering gear is still ready to operate)

This way of steering gear stopping procedure consists in switching-off both electric motors of drive units. The following operations should be effectuated:

- at the bridge control panel:

1. Turn on switch- **Remote drive switching** into position **0** (the green lamp **Pump run** is switched off).

5.7.3 Long-term stopping procedure (e.g. overhaul of steering gear)

This kind of steering gear stopping procedure consists in switching-off both working electric motors of drive units. In order to achieve it, the following operations should be carried-out:

- at the power switchboard of working drive:

1. Set up **Pump operation** switch into position **0,**
2. Turn fan off (**Fan operation** switch should be into position **0**),
3. Set up the **Main switch** into position **0** (the white lamp **Supply** is switched off),
4. **Remote control disconnection** switch should be into position **I**.

5.8 Hydrophore installation

Starting procedure:

1. Open inlet valve to the pressure vessel.
2. Open valve from fresh water tank.
3. Switch one of the sanitary fresh water pumps in the **AUTO** position on the control panel.
4. After reaching **MAX** water level, close inlet valve on the pressure vessel.
5. Open air compressed valve.
6. After achieving air bag pressure 0,6 MPa, close air compressed valve.
7. The water level inside the pressure vessel shall decrease and the air pressure shall drop also. When the air pressure is equal to 0,3 MPa, the differential pressure control switches on the pump and after reaching 0,6 MPa, the pump stops.

6. Diesel generators troubleshooting

A) DG start blocked:

1. **START AIR LOW PRESS**. (lower than 0,4 MPa) . The pressure is measured before the engine - alarm is activated after control system on.
2. **OVERSPEED** alarm on (**RESET AFTER SHUT-DOWN** push-button not confirmed)
3. **FRESH WATER LOW PRESS.** alarm on (**RESET AFTER SHUT-DOWN** push-button not confirmed)
4. **LUB. OIL LOW PRESS**. alarm on (**RESET AFTER SHUT-DOWN** push-button not confirmed)

B) DG shut-down (**RESET AFTER SHUT-DOWN** confirmation is needed)

1. **FRESH WATER LOW PRESS**. – alarm is activated after engine start within min. 460 rev./min.
2. **OVERSPEED** (more than 1050 rev./min.)

C) DG shut-down (**RESET AFTER SHUT-DOWN** confirmation is not needed)

1. Fuel oil low pressure – alarm on

D) DG after start does not achieve ignition revolutions (more than 300 rev./min.)

1. **START AIR LOW PRESS**. (between 0,4 and 1,2 MPa) – active alarm **START FAILURE**

E) DG after start does not achieve ignition revolutions (more than 350 rev./min.) and stops

1. **FUEL OIL LOW PRESS**. – alarm is activated after engine start and min. 350 rev./min - active alarm **START FAILURE**

7. Main Engines and propulsion system troubleshooting

A) ME start blocked:

1. **TURNING GEAR ON** - alarm is activated after turning gear lever on .
2. **START AIR LOW PRESS**. (lower than 0,4 MPa) . The pressure is measured before the engine - alarm active after control system on.
3. **CONTROL AIR LOW PRESS**. (lower than 0,05 MPa) - alarm is activated after control system on.
4. **EMERGENCY STOP** push-button on (**RESET SAFETY SYSTEM** push-button not confirmed)
5. **OVERSPEED** alarm on (**RESET SAFETY SYSTEM** push-button not confirmed)
6. **FRESH WATER LOW PRESS**. alarm on (**RESET SAFETY SYSTEM** push-button not confirmed)
7. **LUB. OIL LOW PRESS**. alarm on (**RESET SAFETY SYSTEM** push-button not confirmed)
8. **GEAR LUB. OIL LOW PRESS**. alarm on (**RESET SAFETY SYSTEM** push-button not confirmed)
9. **CONTROL MODE** push-button in **LOCAL** position
10. Prelubricating pump operation time shorter than 3 min. (inactive indication lamp **ENGINE READY FOR START**)

B) ME – shut down (**RESET SAFETY SYSTEM** confirmation is needed)

a. **LUB. OIL LOW PRESS**. – alarm is activated after engine start within min. 460 rev./min.
b. **FRESH WATER LOW PRESS**. – alarm is activated after engine start within min. 460 rev./min.
c. **GEAR LUB. OIL LOW PRESS**.
d. **OVERSPEED** (more than 1050 rev./min.)
e. **EMERGENCY STOP** push-button on

C) ME emergency stop (without SHUT DOWN)

1. **FUEL OIL LOW PRESS**. alarm on
2. **CONTROL AIR LOW PRESS**. alarm on

D) ME after start does not achieve ignition revolutions (more than 300 rev./min.)

1. **START AIR LOW PRESS**. (between 0,4 and 1,2 MPa) – active alarm **START FAILURE**

E) ME after start does not achieve ignition revolutions (more than 350 rev./min.) and stops

1. **FUEL OIL LOW PRESS**. – alarm is activated after engine start and min. 350 rev./min - active alarm **START FAILURE**

F) Clutch on blocked:

1. ME is not running
2. ME revolutions below 450 rev./min. during starting procedure
3. Propeller pitch different than **O** (concerns only first engine's starting procedure)
4. ME operating time after start shorter than 2 min.(inactive indication lamp **ENGINE READY FOR CLUTCH**)

G) Emergency clutch off:

1. ME stops (by pressing the push-button **STOP**, at revolution lower than 450 rev./min. as well as in all cases of ME emergency stop
2. **CLUTCH/SERVO OIL LOW PRESS** alarm on
3. In case the push-button **CONTROL MODE - LOCAL** is pressed when one or two engines are running (engine revolutions will drop till 460 rev./min, clutch will be disconnected and propeller pitch will be set automatically to **0**)

H) Propeller pitch slow down

1. Propeller pitch slow down will occur (when both engines are running) in the following cases:
   a. when revolution/pitch control lever will be set 5,0 - 8,0 and one of the engines will be stopped or clutch will be off (**SLOW DOWN** alarm will be switched on – the operating engine will keep the same revolution as before the disconnection of the second engine, but the propeller pitch will drop according to the pitch/revolution characteristics for one engine operation).
   b. when revolution/pitch control lever will be set up at a level higher than 8,0 and one of the engines will be stopped or clutch will be off (**OVERLOAD** and **SLOW DOWN** alarms will be switched on - pitch propeller adjustment value will drop according to the pitch/revolution characteristics for single engine operation . Alarm lamps **SLOW DOWN** and **OVERLOAD** will turn off when pitch/revolution values will reach values in accordance with single engine characteristics.

I) Propeller pitch blocked
This case occurs when revolution/pitch control lever is dislocated too fast. The alarm is active at control lever setting up to 5.0. If the control lever movement will be too quick (for e.g. below 2 sec. from lever position 6.0 till 8.0) then the alarm will switch on. For alarm switch off it is necessary to move the control lever below alarm activation position.

8. Software options description

8.1 Telegraph

This option is available from **Main Menu | Options and Telegraph** Fig. 8.1.

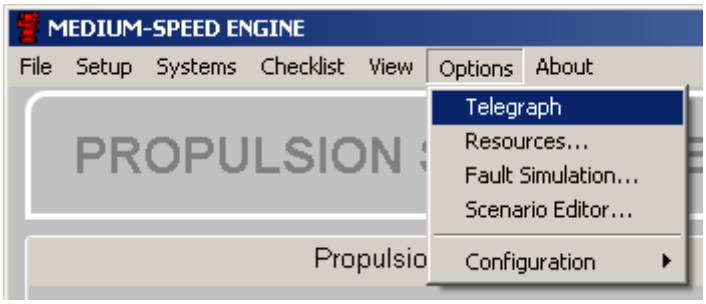


Fig. 8.1 Telegraph

The telegraph order is set by proper push-buttons (in single software version) Fig 8.2

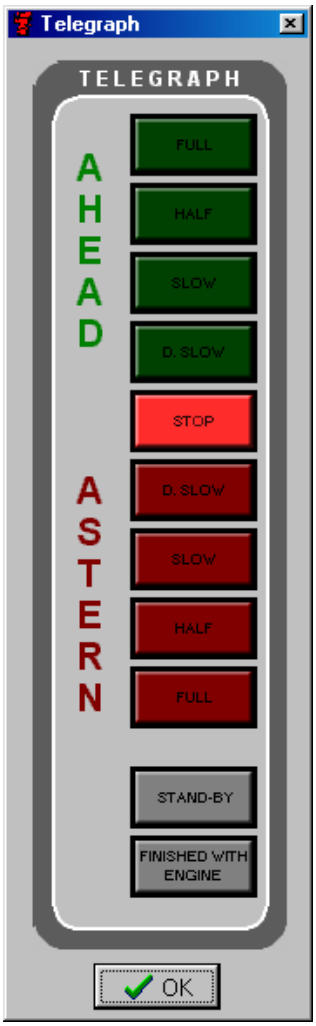


Fig. 8.2 Telegraph panel view

8.2 Console's electronic devices adjustment

This option is available from **Main Menu | Options and Configuration**

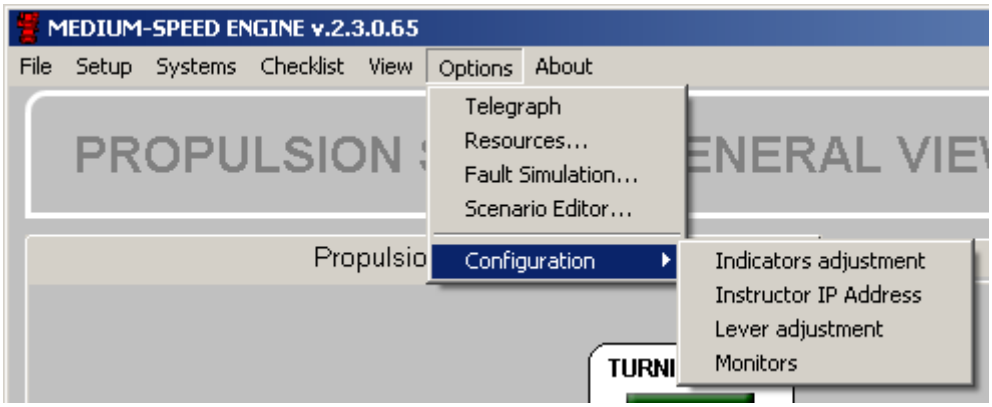


Fig. 8.3 Configuration

and includes:

1. Indicator adjustment
2. Instruction IP address
3. Lever adjustment
4. Software console

1. Indicator adjustment
The purpose of this option is the adjustment of the console analogue gauges . It is available from **Main Menu | Options and Configuration**.
For each indicator it is necessary to set its maximum position using the scrollbar Fig 8.4 and then confirm it by pressing OK button.

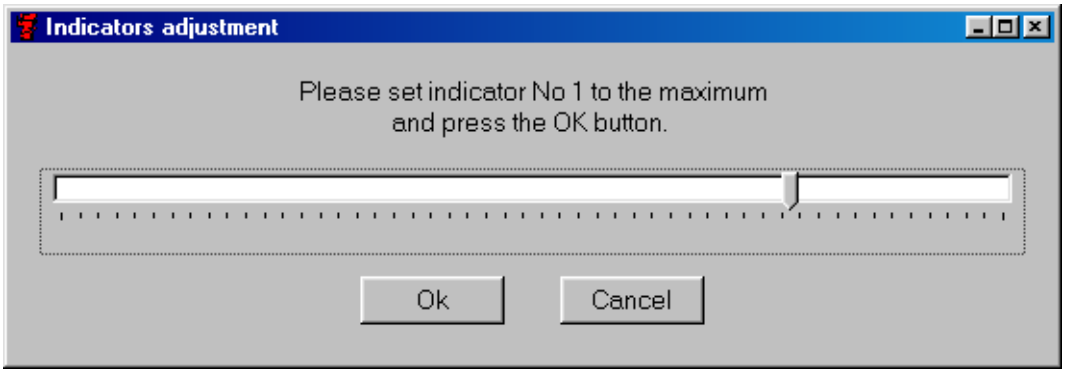


Fig. 8.4 Indicator adjustment

2. Instructor IP address

This function concerns the TCP/IP protocol. This protocol has to be installed and the IP addresses have to be set for each computer Fig 8.5.

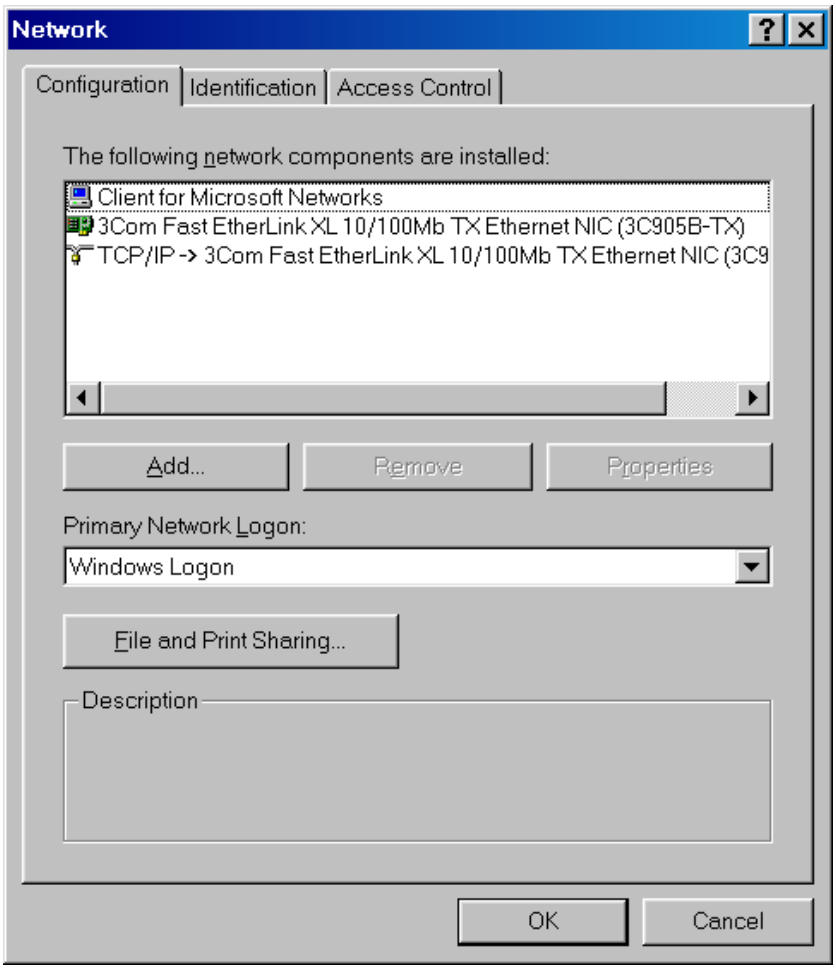


Fig. 8.5 Network configuration

For example for computers where the simulators work the IP number is usually set from 192.168.1.1 to 192.168.1.8 and for the instructor computer 192.168.1.10. (net mask 255.255.255.0) Fig 8.6.

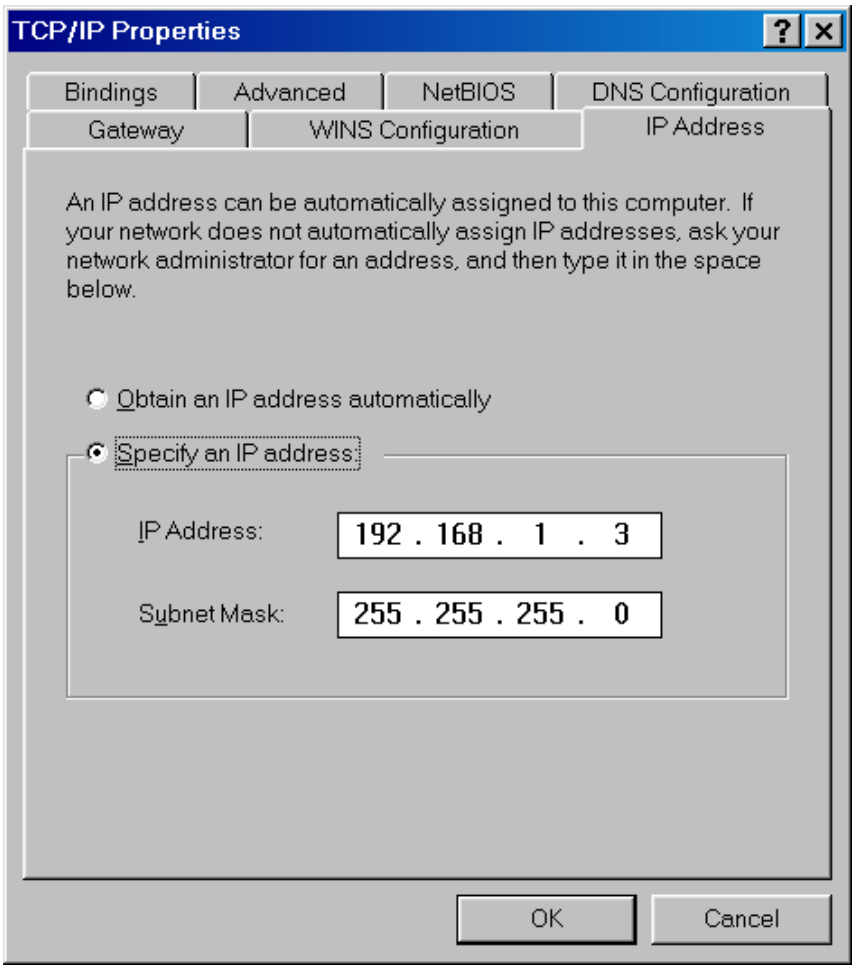


Fig. 8.6 IP address configuration

Additionally, the network Instructor IP address has to be set in simulator. It can be done in **Main Menu** | **Option and Configuration**/ Fig 8.7.

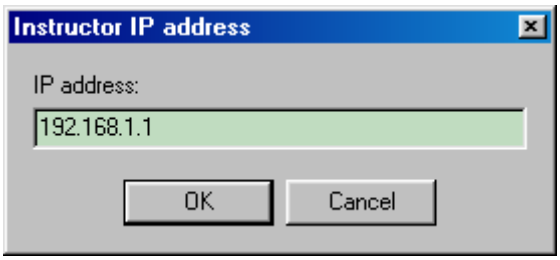


Fig. 8.7 Instructor IP address

3. Control lever adjustment.

This function purpose is control lever calibration. It is necessary to set the lever at the position 10, then press OK button. Repeat the same operation for the position 0 and the – position 10 Fig. 8.8.

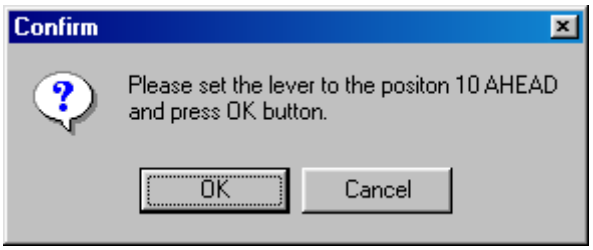


Fig. 8.8 Lever adjustment

8.3 Engine room resources

This option is available from **Main Menu | Options and Resources**

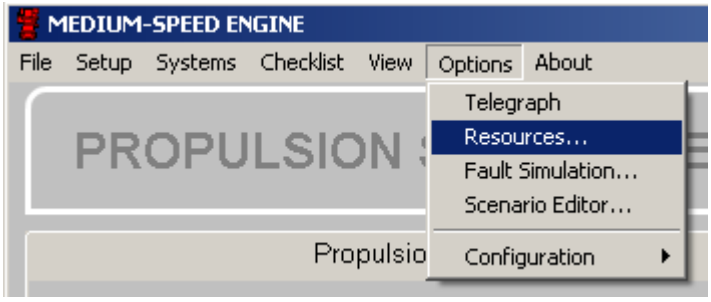


Fig. 8.9 Resources

Resources option allows for the adjustment of the following liquid level in tanks and pressure settlement as well as simulation of aeration of sea pump:

1. Fuel oil level
    a) Bottom tank 1-3
    b) Service tank
    c) Em Gen tank
    d) Fuel oil filters No 1 & 2 Impurity contamination

2. Lubricating oil
    a) Lub. oil level
        - Lub. oil spare tank
        - Dirty oil tank
        - Filters drain oil tank
    b) Crankcase oil level
        - ME No 1
        - ME No 2
    c) Crankcase lost of oil
        - ME No 1
        - ME No 2
    d) Lub. oil filters No 1 & 2 Impurity contamination

3. Compressed air
    a) DG start air press (receiver)
    b) ME start air press (receiver)

4. Gear oil level
    a) Gravity tank
    b) Bottom tank

5. CPP oil level
    a) Gravity tank
    b) Bottom tank

6. Fresh water
    a) fresh water level gravity tank 1- 4

7. Sea water pump aeration
    a) Every time
    b) Only first time
    c) Never

8. Steering gear
    a) Bottom tank 1-3
    b) Unit 1 & 2 lost of oil

9. Bilge and Ballast
    a) bilge tank level
    b) ballast tanks

10. Sanitary fresh water
    a) fresh water tanks 1-3

The levels of resources are changed by moving the suitable Track Bar in Resources Dialogue Box Fig. 8.10.

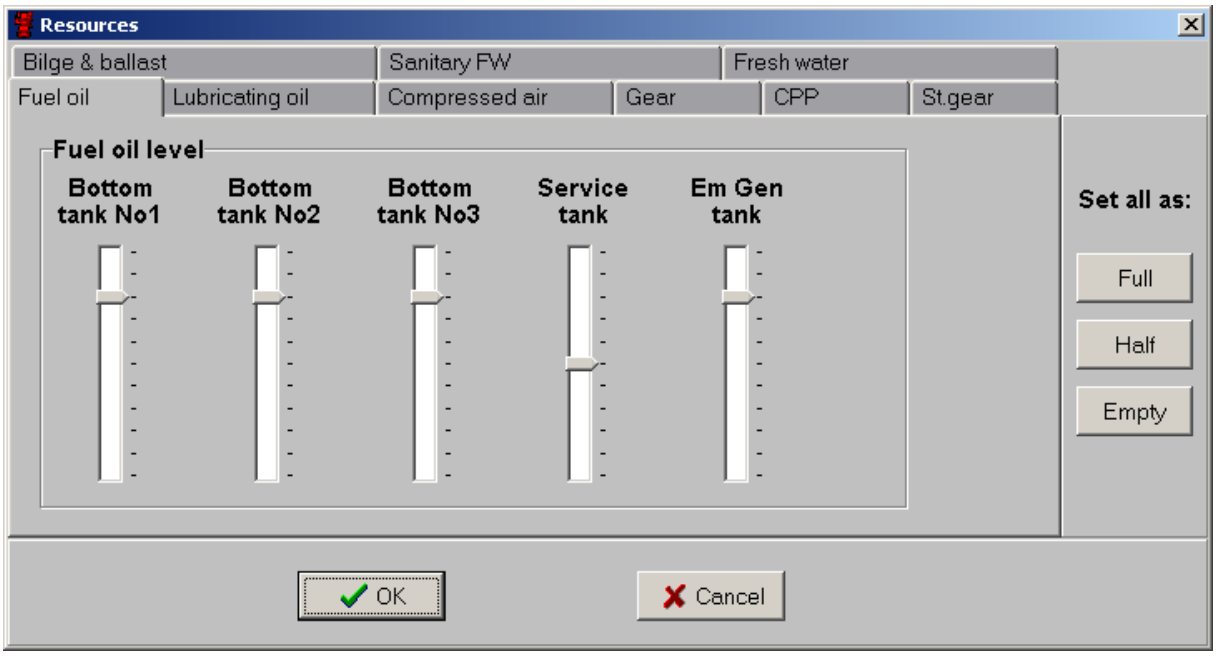


Fig. 8.10 Resources levels

8.4 Scenarios

8.4.1 Scenario concept and use

A scenario is a chain of events that introduce or remove faults from the engine room operation. Each even is described by the following properties:

- Fault name (selected from the given list).
- Fault delay (the delay in seconds between the prior event and the current one).

The MS ERS scenario is stored as a file with (*.scm extension).

The scenario file can be used in the way specified below:

- The scenario can be opened using '**File | Open scenario**' item from the main menu. When the simulator is in Supervised Mode it can be open and send in similar way from Instruction Console. When opened; the scenario will run in the background introducing events stored in scenario file. The running scenario can be compared with the situation when the instructor introduces faults is Supervised Mode. In Supervised Mode there is no visible sign that a scenario is running. In Standalone Mode the 'Open scenario' item is disabled and 'Close scenario' item is enabled in the main menu, and in the 'Fault simulation' window 'Scenario status' shows 'Active' state.

- The scenario can be closed using '**File | Close scenario**' item from the main menu. This means that the scenario event execution is stopped immediately even if not all scenario events have been executed. The open scenario will close automatically when the last event stored in the file is executed. All scenario events (fault simulation) that are still active will remain in the simulator after scenario is closed. The present faults status can be checked and edited when using '**Options | Fault simulation**' option from the main menu. The Fault Simulation window includes Reset All Faults button which will remove all faults introduced during the scenario run, but only if the OK. button is pressed.

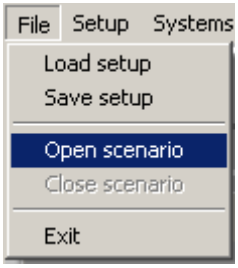


Fig. 8.11 Open scenario

Please keep in mind that when you load or save the setup this does not include currently present faults. Additionally when you load the setup all faults will be reset.

However, before a scenario file can be used it has to be created as a new file or edited as an existing file. The procedure for the creation of a scenario file is described below.

8.4.2 Scenario Editor

The scenario editor will pop up when '**Options | Scenario Editor...**' item from the main menu is selected.

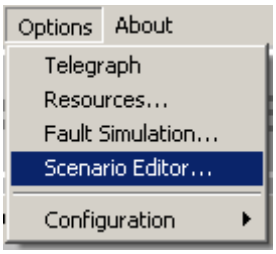


Fig. 8.12 Opening 'Scenario editor'

When invoked, the Edit scenario window opens and is empty as shown in the picture below.

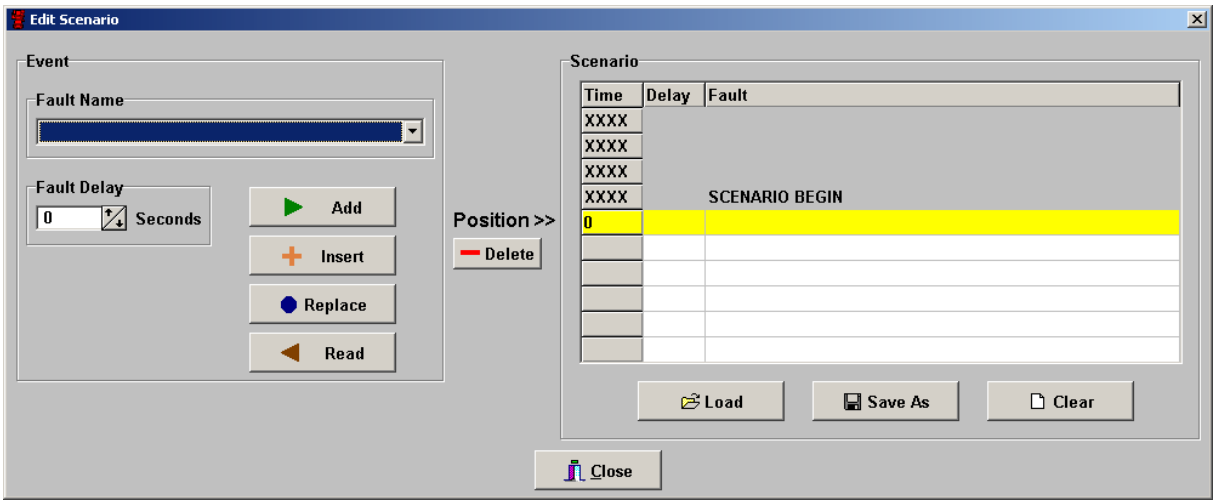


Fig. 8.13 Empty Scenario editor

The left part of the window includes the even editor, the right part includes the grid with the complete list of the events belonging to the edited scenario. The event highlighted in yellow is the current event i.e. event being currently edited. The buttons can be used for the events manipulation in scenario file:

- Add adds the currently edited event to the end of the events list. Typically, this button will be used when adding a new event.
- Insert inserts the currently edited event just before the highlighted position. Typically, this button will be used when inserting a new event between the other events.
- Replace writes over the currently edited event at the highlighted position. Typically, this button will be used together with Read button when editing an existing event.
- Read reads the event being highlighted in the scenario into the event editor. Typically, this button will be used together with Write when editing an existing event.
- Delete deletes the event currently highlighted in the scenario.

An example of a scenario being edited is shown below.

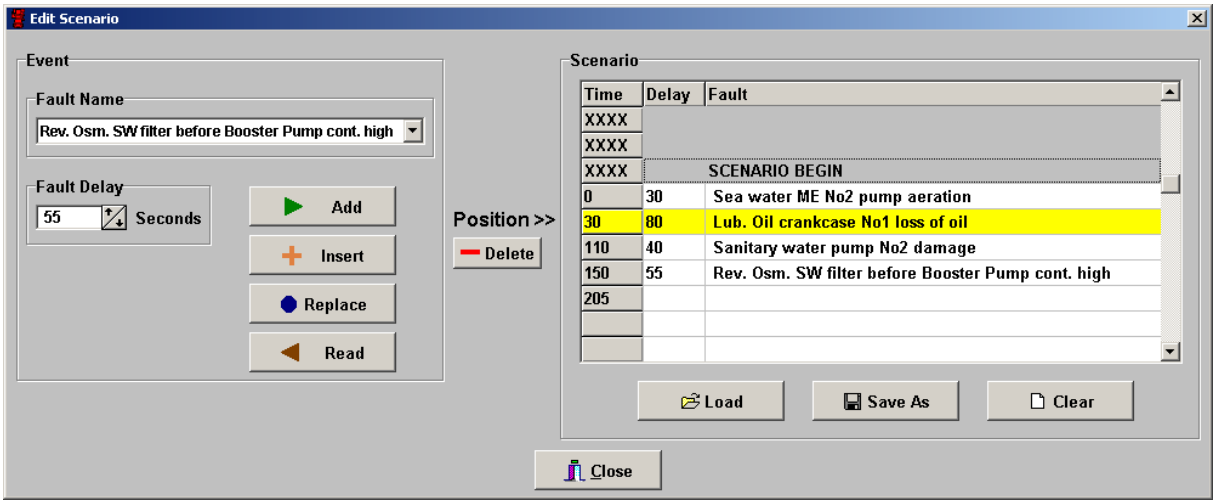


Fig. 8.14 Scenario editor with some scenario example

The three buttons below the scenario grid are dedicated for the scenario file manipulation:
Load: loads the existing scenario file from disc. This will replace completely the scenario being currently edited.
Save As: saves the scenario being currently edited in the scenario file.
Clear: clears the scenario being currently edited. This means that all events will be cleared.

Please keep in mind that when the Edit Scenario window closes, all edited scenarios will be lost unless saved, so the appropriate warning is displayed.

8.5 Fault Simulation

To open 'Fault Simulation' window 'Options / Fault simulation…' command should be selected.

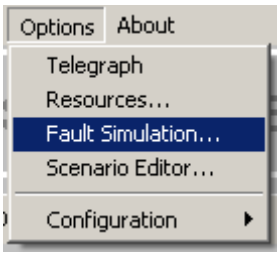


Fig. 8.15 Opening 'Fault simulation' window

The Fault Simulation window contains a list of all available simulations and their status can be monitored and changed. There are two possible states for each fault simulation:

a. 'OFF' - No fault i.e. default technical state.
b. 'ON' - Described fault is simulated.

The fault status will change when clicking at the Fault column of the selected simulation.

The 'Scenario status' in the 'Fault Simulation' window shows if the scenario is currently running or not. When it is 'Active' you may observe the process of adding new faults according to the scenario.

When the 'Fault Simulation' window opens, it shows the current engine room fault status. All currently active faults are also shown in the smaller window below the list. The fault status changed at the list by clicking, does not change component status immediately. Only when the OK button is pressed do all the introduced changes become active. However, clicking at the Cancel button will cancel all changes and close the 'Fault Simulation' window.

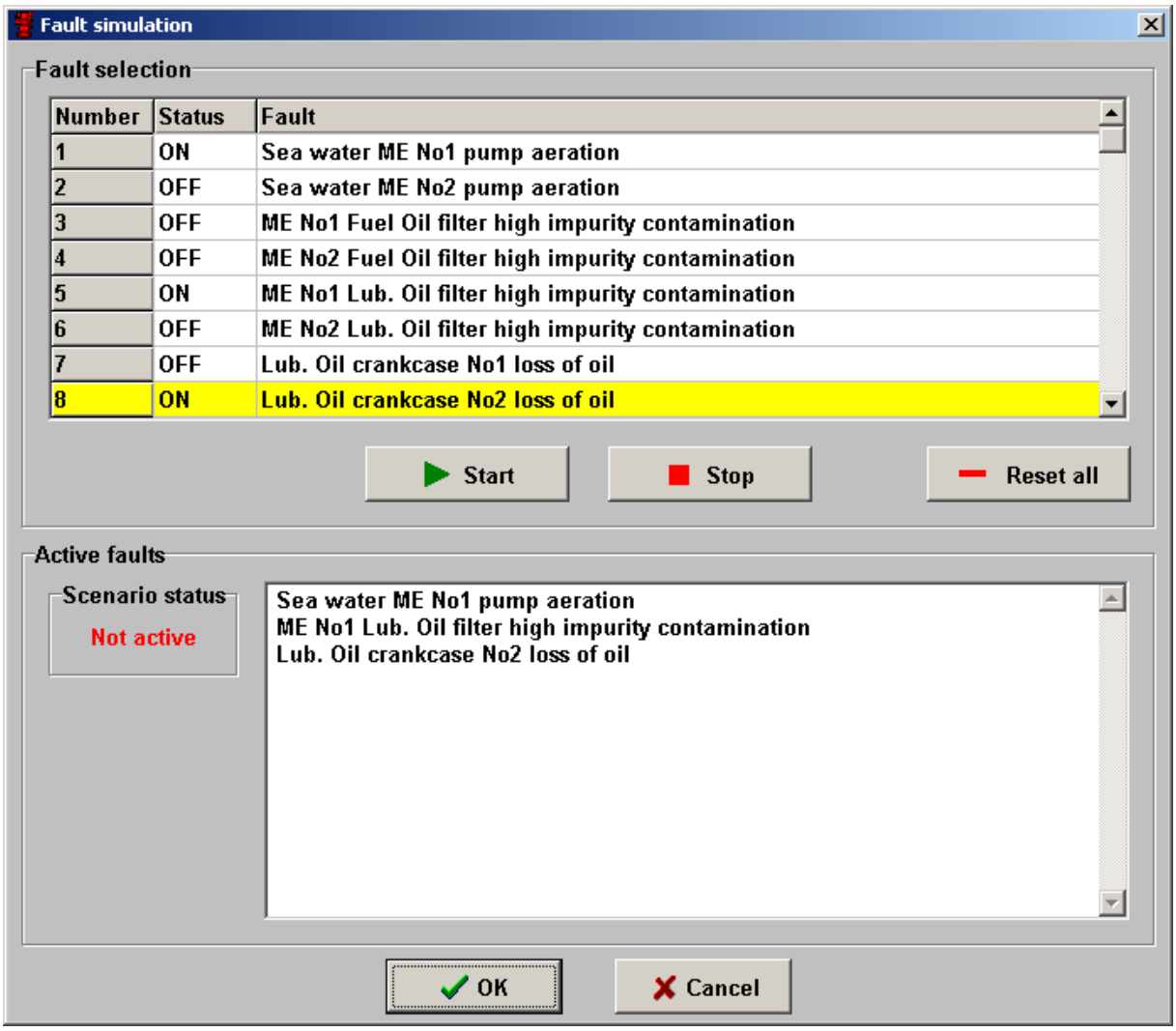


Fig. 8.16 Fault simulation

8.6 Setup

There are 6 standard setup options available in Medium Speed Engine Simulator by **Main Menu | Setup**:

a. Dead
b. DEG ready
c. ME ready for start
d. ME ready for clutch
e. ME No1 full ahead
f. ME No1 & 2 full ahead

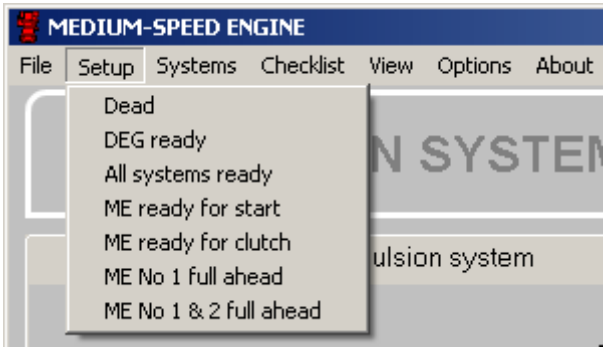


Fig. 8.17 Setup

It is also possible to save any state of engine room on hard drive. For this purpose there is an option in **Main Menu | File and Save Setup**.

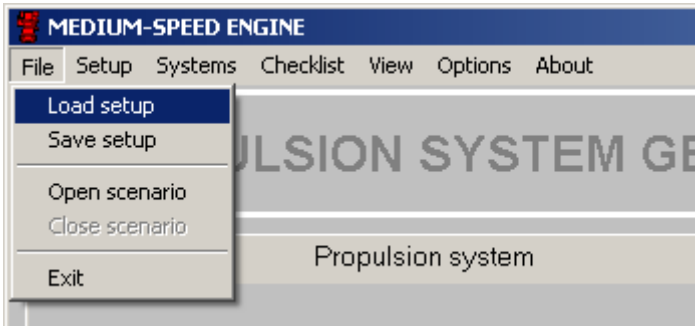


Fig. 8.18 Setup loading

Fig. 8.19 Setup loading Dialogue Box

9. Check List

The main purpose of this option is to :

- standardise operation procedures and training,
- ensure that faults due to improper operation procedures are avoided.

The check list can be especially used for teaching proper engine room operation in stand-alone mode without instructor.

The check list is based on the concept consisting in a division of the whole engine room operation into various smaller, typical tasks. A specific checklist covers all these tasks. Each checklist is based on the following principles:

- each checklist begins with a certain engine room setup, typical for that checklist;
- a checklist properly completed should lead to another specific engine room setup, which is the target of this particular procedure;
- clear instruction what to do and how to do it, is provided for every single checklist step;
- the checklists are linked in such a way that the target setup of one checklist is an entry setup for the next checklist in almost every case. This means that the completion of all checklists procedures results in the knowledge of the whole engine room operation at basic level.

There are 6 standard levels of checklists available in Medium Speed Engine Simulator by **Main Menu | Checklist**:

1. **DG operational**
   Task: to provide voltage on busbars

2. **Auxiliary systems**
   Task: to prepare the start of auxiliary power plant equipment

3. **ME systems**
   Task: to prepare ME systems for operation

4. **ME starting**
   Task: to start ME

5. **ME clutching**
   Task: to clutch ME No 1 and to clutch ME No 2

6. **ME No 1 emergency operation**
   Task: to start and clutch ME No 1 manually

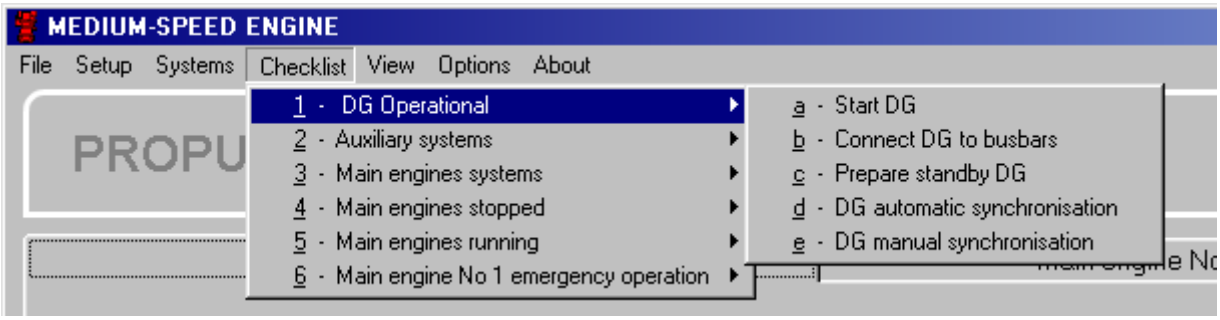


Fig. 9.1 Checklist

After loading the adequate checklist, a clear instruction as to the next step to be completed will appear on the bottom of the screen. Once proper action is completed this particular step of the checklist is passed.

Fig. 9.2 Checklist instruction

Level 1 - DG Operational

1.a Start DG
DG fuel oil valve position after service tank should be set to **OPEN**
DG No 1 fuel oil inlet valve position should be set to **OPEN**
DG start air receiver main valve position should be set to **OPEN**
DG No 1 start air inlet valve position should be set to **OPEN**
DG No 1 fresh water pump inlet valves position should be set to **OPEN**
DG No 1 fresh water inlet valves position should be set to **OPEN**
DG No 1 sea water pump inlet valves position should be set to **OPEN**
DG No 1 sea water pump outlet valves position should be set to **OPEN**
DG No 1 **START SELECTION** switch position should be set to **MANUAL**
DG No 1 **START** button position should be set to **ON**

1.b Connect DG to busbars
DG No 1 **STATOR HEATER** switch position should be set to **ON**
DG No 1 **STATOR HEATER** switch position should be set to **OFF**
DG No 1 **ON** switch in the generator's field position should be set to **ON**

1.c Prepare standby DG
DG No 2 fuel oil inlet valve position should be set to **OPEN**
DG No 2 start air inlet valve position should be set to **OPEN**
DG No 2 fresh water pump inlet valves position should be set to **OPEN**
DG No 2 fresh water inlet valves position should be set to **OPEN**
DG No 2 sea water pump inlet valves position should be set to **OPEN**
DG No 2 sea water inlet valves position should be set to **OPEN**
DG No 2 **START SELECTION** switch position should be set to **AUTO**
DG **ST-BY SELECTION** switch position should be set to **DG 2**

1.d DG automatic synchronization
EM DG **OPERATION SWITCH** position should be set to **AUTO EM'CY**

DG No 2 **START SELECTION** switch position should be set to **MANUAL**
DG **ST-BY SELECTION** switch position should be set to **OFF**
DG No 2 **START** button position should be set to **ON**
Generator **SYNCHRONIZATION** switch position should be set to **DG 2**
SYNCHR. SELECTOR switch position should be set to **AUTO**
AUTO SYNCHR. ON switch position should be set to **ON**

1.e DG manual synchronization
EM DG **OPERATION SWITCH** position should be set to **AUTO EM'CY**
DG No 2 **START SELECTION** switch position should be set to **MANUAL**
DG **ST-BY SELECTION** switch position should be set to **OFF**
DG No 2 **START** button position should be set to **ON**
Generator **SYNCHRONIZATION** switch position should be set to **DG 2**
SYNCHR. SELECTOR switch position should be set to **MANUAL**
The frequency of the synchronized generator should be set slightly above the busbar frequency level by increasing or decreasing the engine speed, with the + , - **SPEED ADJUSTMENT** switch
DG No 1 **ON** switch in the generator's field should be set to ON once the synchronization lamps "dark" are completely extinguished and the LED in the synchroscope is switched on in the position marked with an arrow

Level 2 Auxiliary systems

2.a Fresh water hydrophore
Outlet valve from one of the fresh water storage tanks position should be set to **OPEN**
Inlet valve to the pressure vessel position should be set to **OPEN**
Sanitary water pump No 1 switch position should be set to **AUTO**
Inlet valve to the pressure vessel position should be set to **CLOSED**, after reaching **MAX** water level
Compressed air valve under the pressure vessel position should be set to **OPEN**
Compressed air valve under the pressure vessel position should be set to **CLOSED**, after achieving air bag pressure 0,6 MPa
Inlet valve to the pressure vessel position should be set to **OPEN**

2.b Reverse osmosis desalination system
Reverse osmosis sea water intake valve position should be set to **OPEN**
Back Pressure Regulator Valve position should be set to 100% **OPEN**
Booster Pump switch position should be set to **AUTO**
High Pressure Pump **START** switch should be set to **ON**
One of the inlet valves to the Fresh Water Tank position should be set to **OPEN**
Back Pressure Regulator Valve position should be set to about 40% **OPEN** (about 6MPa)

2.c Oily water separator
Separator system **Mode** switch position should be set to **AUTO**
Separator system **HEATER** switch position should be set to **ON**
Separator system **MANUAL** switch position should be set to **OFF**
Separator system **SUPPLY** switch position should be set to **ON**
Separator system **RESET** switch position should be set to **ON**

2.d Steering gear
Drive unit 1 Main Switch position should be set to **ON**
Drive unit 1 Pump operation switch position should be set to **Remote Operation**
Drive unit 1 Remote disconnection switch position should be set to **OFF**
Drive unit 1 Fan operation switch position should be set to **AUTO**
Drive unit 2 Main Switch position should be set to **ON**
Drive unit 2 Pump operation switch position should be set to **Remote Operation**
Drive unit 2 Remote disconnection switch position should be set to **OFF**
Drive unit 2 Fan operation switch position should be set to **AUTO**

2.e Refrigerating system
Shut-off valve placed at suction compressor line position should be set to **OPEN**
Main Switch position should be set to **ON**

Shut-off valve after condenser cooling pump position should be set to **OPEN**
Condenser cooling pump switch position should be set to **ON**
Compressor switch position should be set to **ON**
Shell and coil condenser outlet valve should be set to **OPEN**
Shell and coil condenser inlet valve should be set to **OPEN**

Level 3 ME systems

3.a Prepare fresh water cooling system
Auxiliary fresh water pump inlet valve position should be set to **OPEN**
Auxiliary fresh water pump outlet valve position should be set to **OPEN**
Fresh water preheater inlet valve position should be set to **OPEN**
Fresh water preheater outlet valve position should be set to **OPEN**
ME No 1 fresh water inlet valve from auxiliary fresh water pump position should be set to **OPEN**
ME No 2 fresh water inlet valve from auxiliary fresh water pump position should be set to **OPEN**
ME No 1 fresh water outlet valve to auxiliary fresh water pump position should be set to **OPEN**
ME No 2 fresh water outlet valve to auxiliary fresh water pump position should be set to **OPEN**
Auxiliary fresh water pump **START** switch position should be set to **ON**
Fresh water preheater **START** switch position should be set to **ON**
ME No 1 fresh water inlet valve position should be set to **OPEN**
ME No 1 fresh water pump inlet valves position should be set to **OPEN**
ME No 2 fresh water inlet valve position should be set to **OPEN**
ME No 2 fresh water pump inlet valves position should be set to **OPEN**

3.b Sea water cooling system
Auxiliary sea water pump inlet valve position should be set to **OPEN**
Auxiliary sea water pump outlet valve position should be set to **OPEN**
Auxiliary sea water pump outlet valve before ME No 1 position should be set to **OPEN**
ME No 1 sea water inlet valve position should be set to **OPEN**
ME No 1 sea water pump inlet valves position should be set to **OPEN**
Auxiliary sea water pump outlet valve before ME No 2 position should be set to **OPEN**
ME No 2 sea water inlet valve position should be set to **OPEN**
ME No 2 sea water pump inlet valve position should be set to **OPEN**
Auxiliary sea water pump **START** switch position should be set to **ON**

3.c Lubricating oil system
ME No1 prelubricating pump switch position should be set to **AUTO**
ME No2 prelubricating pump switch position should be set to **AUTO**

3.d Compressed air system
ME compressor switch position should be set to **AUTO**
ME air receiver main valve position should be set to **OPEN**
Me No 1 start air inlet valve position should be set to **OPEN**
Me No 2 start air inlet valve position should be set to **OPEN**
Control air supply valves position should be set to **OPEN**

3.e Gear system
Gear system **SUPPLY** switch position should be set to **ON**
Gear lubricating oil pump No 1 **START** switch should be set to **ON**
Gear lubricating oil pump switch position should be set to **Stand-by No 2**
Clutch/servo oil pump No 1 **START** switch should be set to **ON**
Clutch/servo oil pump switch position should be set to **Stand-by No 2**
Auxiliary lubricating oil pump switch position should be set to **AUTO**

3.f CPP system
CPP system pump operation switch position should be set to **Remote**
CPP system **SUPPLY** switch position should be set to **ON**
CPP/servo oil pump No 1 **START** switch should be set to **ON**
CPP/servo oil pump switch position should be set to **Stand-by No 2**

CPP lubricating oil pump switch position should be set to **AUTO**

3.g Fuel system
ME No 1 fuel oil valve after service tank position should be set to **OPEN**
ME No 1 fuel oil inlet valves position should be set to **OPEN**
ME No 2 fuel oil valve after service tank position should be set to **OPEN**
ME No 2 fuel oil inlet valves position should be set to **OPEN**

Level 4 ME stopped

4.a Prepare ME to start
Indicator valves of ME No 1 position should be set to **OPEN**
Indicator valves of ME No 2 position should be set to **OPEN**
ME No 1 turning gear lever position should be set to **ENGAGED**
ME No 2 turning gear lever position should be set to **ENGAGED**
ME No 1 turning gear switch should be set to **ON**
ME No 2 turning gear switch should be set to **ON**
ME No 1 turning gear switch should be set to **OFF**
ME No 2 turning gear switch should be set to **OFF**
ME No 1 turning gear lever position should be set to **DISENGAGED**
ME No 2 turning gear lever position should be set to **DISENGAGED**
Indicator valves of ME No 1 position should be set to **CLOSED**
Indicator valves of ME No 2 position should be set to **CLOSED**

4.b Start ME
RPM potentiometer position should be set to **IDLE value**
LOAD ADJUSTMENT potentiometer position should be set to **0** position
Revolution/pitch lever position should be set to **0**
ME No 1 **START** button position should be set to **ON**
ME No 2 **START** button position should be set to **ON**
Auxiliary sea water pump **STOP** switch position should be set to **ON**
Auxiliary sea water pump inlet valve position should be set to **CLOSED**
Auxiliary sea water pump outlet valve position should be set to **CLOSED**
Auxiliary sea water pump outlet valves before ME No 1 position should be set to **CLOSED**
Auxiliary sea water pump outlet valves before ME No 2 position should be set to **CLOSED**
Fresh water preheater position **STOP** switch should be set to **ON**
Auxiliary fresh water pump **STOP** switch position should be set to **ON**
Auxiliary fresh water pump inlet valve position should be set to **CLOSED**
Auxiliary fresh water pump outlet valve position should be set to **CLOSED**
Fresh water preheater inlet valve position should be set to **CLOSED**
Fresh water preheater outlet valve position should be set to **CLOSED**
ME No 1 fresh water inlet valve from auxiliary fresh water pump position should be set to **CLOSED**
ME No 2 fresh water inlet valve from auxiliary fresh water pump position should be set to **CLOSED**
ME No 1 fresh water outlet valve to auxiliary fresh water pump position should be set to **CLOSED**
ME No 2 fresh water outlet valve to auxiliary fresh water pump position should be set to **CLOSED**

Level 5 ME running

5.a Clutch ME No 1
ME No 1 switch **CLUTCH – ON** position should be set to **ON**
Revolution/pitch lever position should be set to demanded value

5.b Clutch ME No 2
ME No 2 revolution **RPM** potentiometer (with a tolerance of +/- 20 RPM) should be set to accordance with the first engine revolution value.
ME No 2 switch **CLUTCH – ON** position should be set to **ON**

Level 6 ME No 1 emergency operation

6.a ME No 1 local start
LOCAL switch position located on Console should be set to **ON**
ME No 1 **START** Button on Local panel position should be set to **ON**
6.b ME No 1 manual clutch
ME No 1 clutch manual switch position should be set to **ON**

10. Alarm Log

The Event Log window can be used to get an overview of the user activities. This window can be opened by mouse clicking on the **View | Alarm log** item from the main menu.

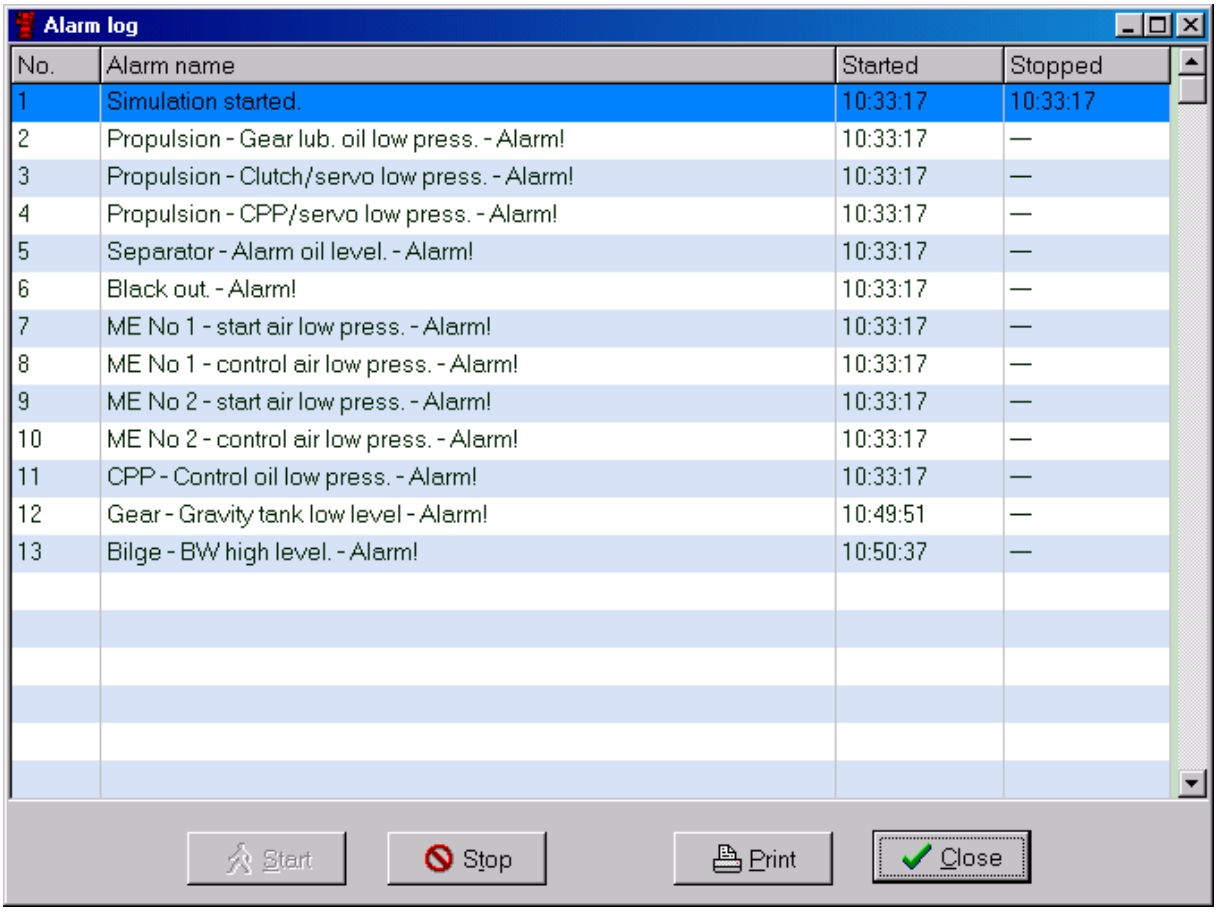


Fig.10.1 Alarm Log

The alarm log contains the following information:

- full name of alarm;
- time of alarm activation;
- time of alarm deactivation;
- information about loading setup.

It is possible to print all the alarm log by using Print push-button.

11. Freezing Simulator

The simulator allows the user to freeze the simulation. This option is very useful at the early stage of the training when a trainee needs more time to analyse the situation.

Fig. 11.1 Freezing simulator

Please keep in mind that 'to freeze' the simulation means that the model calculation is stopped and the user can not operate any controls, buttons or switches of the different systems.