	DIRECTORATE GENERAL OF SHIPPING, GOVT.OF INDIA, MUMBAI	
Ref.: QMS 7.0 Page 1 of 109	**Subject: Guidelines for Maritime Training Institutes for obtaining approval from D.G. Shipping to conduct Engine Room Simulator courses for Engineer Officers.**	**F. No.** File No. Eng/TRG-33(1)/2018
Issued by the Director General of Shipping Govt. of India	**Training Circular No. 02 of 2019**	**Date : 04.02.2019**

1. In order to provide knowledge and skills related to operation, supervising and monitoring the safe operation and control of Ships machinery for Engineering officers specified in Table A-III/1 and A-III/2 of SCTW Code as amended, the Directorate General of Shipping has formulated guidelines for conduct of the following three courses and annexed to this Circular :

1.1 Engine Room Simulator Course for Officers In-charge of an Engineering Watch in a manned engine room or Designated Duty Engineers in Periodically unmanned Engine Room – Course ID : 3121;

1.2 Engine Room Simulator Course for Second Engineer Officers at the Management Level on Ships powered by main propulsion machinery of 3000 KW Propulsion Power and above – Course ID- 3211;

1.3 Engine Room Simulator Course for MEO Class 1 Officers at the Management Level on Ships powered by Main Propulsion Machinery of 3000 KW propulsion power and above – Course ID 3221.

2. The processing fees in respect of the above mentioned three courses is Rs. 75,000/- for each.

3. This issues with the approval of Director General of Shipping (I/C), Govt. of India.

Yours faithfully,

(Ashish Wankhede)
Deputy Director General of Shipping

MANDATORY GUIDELINES FOR TRAINING INSTITUTES FOR OBTAINING APPROVAL FROM DIRECTORATE GENERAL OF SHIPPING

TO CONDUCT

ENGINE ROOM SIMULATOR COURSE FOR OFFICERS IN CHARGE OF AN ENGINEERING WATCH IN A MANNED ENGINE ROOM OR DESIGNATED DUTY ENGINEERS IN PERIODICALLY UNMANNED ENGINE ROOM

COURSE ID: 3121

To avoid unnecessary repetition, reference has been made herein to DG Shipping Training Manual (Training Circular 31 of 2018) wherever appropriate.

TABLE OF CONTENTS

(216)

Engine Room Simulator Course for Officers in charge of an Engineering Watch in a Manned Engine Room or Designated Duty Engineers in Periodically Unmanned Engine Room

1.0 BASIC DETAILS OF THE COURSE

.1. **Aims:**

This course covers the training recommended in the IMO Model Course 2.07 and fulfils the simulator training requirement for Engineering officers at the Operational Level, specified in Table A-III/1 of STCW Code as amended, to provide knowledge and skills related to operation, supervising and monitoring the safe operation and control of ship's machinery.

.2. **Objectives:**

The trainee who successfully completes this course will have gained experienced in running, operation and maintenance of engine-room machinery under various conditions and will make a more effective contribution to the engine room team during normal and emergency situations.

In particular, the trainees will be able to have:

1.2.1 familiarization with the use of instrumentation and controls used in the engine rooms of modern merchant ships

1.2.2 an awareness of the need for proper pre-planning, the use of checklists and of the timescale involved in starting up propulsion plant machinery

1.2.3 experience in identifying operational problems and trouble-shooting

1.2.4 the ability of logical decision making which promotes operational safety

2.0 QUALIFICATION & ELIGIBILITY OF STUDENTS

2.1 Entry standards:

Prior to gaining entry into this course, the trainee should have:-

- Successful completion of DG Shipping approved Pre-sea engineering course as per Training, Examination and Assessment Programme (TEAP) Part A Flow Diagram III/1
- Minimum of 6 months sea time in a manned engine-room or periodically unmanned engine-room on a seagoing ship powered by main propulsion machinery of 750 kW or more as a first assistant to Engineer Officer in charge of watch.

2.2 Required attendance:

100% attendance is required for successful completion of the course.

2.3 Course intake limitations:

The course intake shall be a maximum of 8 trainees divided into two teams. Depending on the facilities provided, one team would be carrying out an exercise while the other is being lectured, debriefed or planning the next exercise.

(215)

3.0 INFRASTRUCTURE REQUIREMENT :

Training centre's seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process. All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.

3.1 Engine Room Simulator

The Engine Room Simulator shall be type approved by DG Shipping on demonstrating its capability of fulfilling the requirements of Appendix 2 of IMO Model Course 2.07 Engine Room Simulator (2017 Edition)

Simulator Specifications: As per Annexure 2

3.2 Briefing / Debriefing Room

Briefing / Debriefing room shall be of minimum area of 12 sq. and equipped with a white / black board, overhead / LCD projector / monitor, PC/ Laptop.

4.0 COURSE DETAILS

4.1 Course Duration: 3 days (21 hours)

4.2 Course Outline: As per given in Annexure 1

4.3 Course Certificate: As per format given in Annexure 3.

5.0 HOLIDAYS

5.1 Sundays shall be holidays.

5.2 Independence Day (15th August) and Republic Day (26th January) shall be compulsory holidays.

5.3 Students shall normally enjoy the holidays observed by the Govt. of the State in which the institute is located.

6.0 FACULTY REQUIREMENT

6.1 Qualifications and experience of course in charge:

Course In-charge shall :

- hold Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- have not less than 5 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course

6.2 Qualifications and experience of faculty members:

The faculty shall :

- Hold a Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- Have not less than 4 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course

6.3 Visiting faculty members:

5

(214)

Qualifications and experience of visiting faculty members should be the same as that of regular faculty as specified above.

6.4 All faculty members shall hold Training of Trainers & Assessors Course Certificate. (TOTA / VICT) (as per DGS Circular 26 of 2018, VICT course)

6.5 Age limit for regular faculty members:
As per Training Manual (Training Circular 31 of 2018)

7.0 FACULTY STRENGTH

7.1 Not less than two faculty, of which one could be the course-in-charge. The Faculty: Trainee ratio shall be not more than 1:8 for theory sessions and 1:4 for simulation exercises.

7.2 Minimum of 50% of the entire portion must be covered by full time faculty. (As per Training Manual (Training Circular 31 of 2018).

8.0 COURSE DURATION
A total of 18 hours of lectures, including simulation training and assessment.

9.0 ASSESSMENT
Assessment would be carried out at the end of each course.

10.0 QUALITY STANDARDS
As per Training Manual (Training Circular 31 of 2018).

11.0 INSPECTIONS
As per Training Manual (Training Circular 31 of 2018).

12.0 COST OF INSPECTIONS
As per Training Manual (Training Circular 31 of 2018 and Training Circular 29 of 2018)

13.0 FEES TO GOVT.
As per Training Manual (Training Circular 31 of 2018)

14.0 TEACHING AIDS

PUBLICATIONS:

IMO references (mandatory)

R1: International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, (STCW) 1978 as amended.
R2: IMO model courses: 7.04 - Officer in charge of an Engineering Watch
R3: IMO Model Course 2.07 – Engine Room Simulator

Textbooks (mandatory)

T1: Instruction books on operation of the simulator

Bibliography (non-mandatory)

B1. Taylor, D.A. Introduction to Marine Engineering. 2nd ed. London, Butterworth. 1990 (ISBN 07-50-6253-9)
B2. Diesel Engines for Ship Propulsion and Power Plants, Volume I & II. K. Kuiken Target Global Energy (ISBN 978-90-79104-02-4)
B3. Pounder's Marine Diesel Engines and Gas Turbines, 8th edition (ISBN 0-7506-5846-0)
B4. McGeorge H.D., Marine Auxiliary Machinery, Seventh Edition, Butterworth-Heinemann, 1995 (ISBN 0 7506 4398 6)
B5. Application of Automatic Machinery and Alarm Equipment in Ships; R. G. SMITH; Institute of Marine Engineers; (ISBN: 0900976152).
B6. IMO Model Course 6.10 – train the Simulator Trainer

15.0 Course Outline and Simulator Exercises – As given in Annexure 1.

16.0 Engine room simulator specifications - Annexure 2

17.0 Sample certificate to be issued on successful completion of course - Annexure 3

ANNEXURE – 1 COURSE OUTLINE

	Knowledge, understanding and proficiency (Learning Objectives)	Theory (Hours)	Simulation (Hours)
1.	**Familiarisation**	0.5	
1.1	Plant arrangements		1.5
1.2	Instrumentation		1.5
1.3	Alarm system		1.0
1.4	Control system		1.0
2.	**Operation of plant machinery**		
2.1	Operational procedures	0.5	
2.2	Operate main and auxiliary machinery and systems		1.5
2.3	Operation of diesel generator		1.5
2.4	Operation of steam boiler		1.5
2.5	Operation of steam turbo generator		
2.6	Operation of fresh water generator		
2.7	Operation of pumping system		1.5
2.8	Operation of oily water separator		
2.9	Fault detection and measures		1.0
3.	**Maintain a safe engineering watch**	0.5	
3.1	Thorough knowledge of principles to be observed in keeping an engineering watch		1.0
3.2	Safety and emergency procedures; change- over of remote/automatic to local control of all systems		1.0
3.3	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems		1.5
3.4	Knowledge of engine room resource management principles		1.5
4.	**Operate electrical, electronic and control systems**	0.5	
4.1	Operation of main switch board		1.5
	Assessment	0.5	
	Total	2.5	18.5
	Grand Total	**21 hrs**	

All times indicated above include briefing, debriefing and assessment.

SIMULATOR EXERCISES

Note: The values mentioned in the exercises are based on a particular type of engine. These values may vary depending on the type of engines being simulated. The instructor should accordingly set the values appropriate to the engine being simulated.

Sample exercise-1

Exercise Title	**Familiarization-1**
Task	Trace machinery and pipeline layout in the machinery space
Function and Level	Marine engineering at the operational level
Outline of Training	Individual trainee works on tracing propulsion plant machinery and piping lines presented on the illustrating/mimic panel
Initial Condition	Not in operation
Specific Purpose	The training allows the trainees to: - understand how the propulsion plant is constructed - understand machinery systems which construct the plant - understand how the systems and machinery are connected - understand meaning/significance of piping lines
Briefing	Explain briefly the following This training gives understanding of construction of propulsion system and preliminary knowledge for plant operation Outline of the training - propulsion plant is mainly constructed by main machinery, power generation system, steam generation systems and other auxiliary machinery - the importance of understanding roles of these machinery systems and machinery which construct each system - a need to understand how these systems are connected by piping lines
Implementation	Let the trainees: - trace main machinery and its associated systems such as fuel supply, lubricating oil supply, cooling water circulation, air supply and exhaust gas systems with tanks, main valves, pumps, heaters and coolers - trace power generation system and its associated systems such as generators, prime movers, fuel supply/steam supply, cooling water circulation systems with tanks, main valves, pumps and coolers - trace steam generation system and its associated systems such as exhaust gas economizer, fuel supply, feed water, steam supply and condensate water systems with tanks, main valves, pumps, cooling water circulation, heaters and coolers - trace fuel transfer and treatment systems with tanks, main valves, pumps, purifiers and heaters - trance cooling fresh water and sea water systems with tanks, main valves, pumps, fresh water generator and coolers - trace compressed air systems with air compressors, air reservoirs and main valves, - trace lubricating oil treatment system with lubricating oil purifiers and

Exercise Title	Familiarization-1
	heaters - trace bilge treatment system with separator, incinerator, tanks, bilge wells, pumps and main valves - trace stern tube lubricating oil system with stern tube gravity tanks high and low, stern tube aft and fwd seal tanks, drain tank, pumps and cooler. - trace sewage plant system pipelines and connection to sea water system
Debriefing	Explain briefly the following - functions and features of piping lines - functions and features of tanks, particularly FW expansion tank - installations fitted on the piping lines installations fitted on the piping lines and various types of valves and their correct operation. - differences between local control, remote control and automatic control - control methodologies applied to the machinery

Sample exercise-2

Exercise Title	**Familiarization-2**
Task	Operate instrumentation system to measure the running parameters of the main engine/auxiliary machinery
Function and Level	Marine engineering at the operational level
Outline of Training	Individual trainee works on a check list reading indication meters of the simulated plant machinery on the mimic panel or illustrating panel and observing displays of instruments on the main console and main switch board
Initial Condition	Harbour transit
Specific Purpose	The training allows the trainees to: - get to know names and functions of instrumentations used to indicate running parameters and status of the plant machinery - understand difference between an analogue meter and digital indicator and their advantages and disadvantages - get familiar with reading indicators including unit - observe indicator diagrams displayed on the screen of an engine power meter or monitoring system
Briefing	Explain briefly the following This training gives understanding of instrumentation used in a ship's propulsion plant Outline of the training - various instrumentation is used to indicate various process values that are running parameters of the machinery - the importance of reading correctly these indications to ensure proper judgement of the running condition
Implementation	Start the simulation and let the trainees enter the engine room and: - start reading indications of various meters on the mimic panel or illustrating panel following the check list The instructor lets the trainees enter the control room and: - start reading indications of various meters on the main console and main switch board The instructor stops the simulation and creates standby engine as an initial condition and lets the trainees: - operate main engine manoeuvring lever in turn and observes p/v diagrams and draw curves of the main diesel engine on the display of monitoring system or engine power meter unit
Debriefing	Explain briefly the following - almost all running parameters can be seen on the display of monitoring system in an actual ship - actual thermometers, pressure gauges, level gauges and other process indicators are installed in an actual ship - usually there is a difference in indication values between actual meters and the monitoring system in an actual ship - the importance to remember approximate values of running parameters

Sample exercise-3

Exercise Title	**Familiarization-3**
Task	Operate alarm system used to indicate malfunctions and emergency
Function and Level	Marine engineering at the operational level
Outline of Training	Individual trainee performs operation of alarm system identifying malfunction in turn
Initial Condition	Sea-going
Specific Purpose	The training allows the trainees to: - get to know difference between general alarm/emergency alarm and engine alarms - understand pattern of machinery alarms - understand how to respond to an alarm sound - meaning of alarm sound, lamp indications and lamp flicker - understand how to change alarm setting values - understand basic functions of monitoring system
Briefing	Explain briefly the following - how to respond to machinery alarms of instrumentation used in a ship's propulsion plant - basic functions of a monitoring system used for propulsion plant machinery - difference between general alarm and machinery alarms - meaning of buzzer stop button, reset/flicker stop button and alarm indication lamps
Implementation	Start the simulation and let the trainees: - perform buzzer test and lamp test in turn - respond to an alarm entered by the instructor - press buzzer stop button to stop the alarm sound - make sure what was alarmed and the malfunction machinery with lamp flicker - press reset/flicker stop button and make sure the lamp becomes continuous lighting - make sure the alarming value of parameter/status of the machinery - make sure that the alarm lamp lights until the alarmed parameter becomes normal - make sure that the alarm was recorded in the event printer/alarm printer with time of occurrence and stored in the monitoring systems until the alarmed parameter becomes normal (Instructor makes alarms one after another until the trainees become familiar with the response) - make changes in alarm setting value of running parameters for the monitoring system such as temperature, pressure, level and time-lag for alarming
Debriefing	Explain briefly the following - summary of the training - meanings of audible and visible alarm - an alarming system cannot be used in principle for a safety system

Exercise Title	Familiarization-3
	- three categories of alarm that are emergency alarm, primary alarm and secondary alarm

Sample exercise-4

Exercise Title	**Familiarization-4**
Task	Identify equipment used for controls
Function and Level	Marine engineering at the operational level
Outline of Training	Individual trainee works on a check list for identifying equipment used for controls in the simulated propulsion plant
Initial Condition	Not in operation
Specific Purpose	The training allows the trainees to: - understand what machinery is remotely and/or automatically controlled - understand what process values are automatically controlled - identify what equipment is used for controls
Briefing	Explain briefly the following: - outline of the training - how to carry on the training - differences between remote control and automatic control - control methods applied to main machinery

Implementation	The instructor lets the trainees identify equipment used for controls following the check list:
	- remote-automatic control
	  - main engine control stand/panel in the engine room and control room
	  - main engine manoeuvring lever in the engine room and control room
	  - auxiliary blower control switch
	  - generator control panel on main switch board and main console
	  - synchronizing panel on main switch board
	  - auxiliary boiler control panel
	  - purifier control panel
	- remote control
	  - group starter panels (G.S.P.)
	- automatic control
	  - temperature controllers
	  - level controllers
	  - pressure controllers
	  - viscosity controllers
	  - control valves
	  - start and stop in group starter panels

Debriefing	Explain briefly the following - control methods applied to: actual main engine, power generation system and boiler controls - actual automatic control for temperature, level and other process values - actual automatic start and stop of auxiliary machinery

Sample exercise-5

Exercise Title	**Operation of plant machinery**
Task	Line up and establish auxiliary machinery systems
Function and Level	Marine engineering at the operational level
Competence	Operate main and auxiliary machinery and associated control systems
Requirements (K.U.P.)	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems .1 main engine and associated auxiliaries .2 steam boiler and associated auxiliaries and steam systems .3 auxiliary prime movers and associated systems .4 other auxiliaries including refrigeration, air conditioning and ventilation systems
Outline of Training	trainees establish a group and the group performs operations of the following machinery in the engine room; - start and stop emergency generator - start, stop and change over CSW pumps and LTFW pumps - start, stop and change over main air compressors - start and stop control air compressor - start, stop and change over oil purifiers The trainees may refer to a procedure manual prepared by instructors. All operations should be principally carried out in manual. This training is not for plant operation but for operation of each machinery, therefore same procedures may be sometimes repeated.
Initial Condition	- Cold ship (FW, FO and LO are loaded, No machinery is in service, All valves are principally closed)
Specific Purpose	The training allows the trainees to: - understand how to start, stop and changeover auxiliary machinery - acquire knowledge on preparations and procedures for starting, operating and stopping machinery and their procedural theories
Briefing	Explain briefly the following - outline of the training - how to carry on the training - purposes of starting each machinery and establishing systems - procedures for starting, operating and stopping each machinery and their procedural theories applied to the machinery - significance to keep correct sequence of the procedures to prevent damage - needs to check running condition in terms of sounds, vibration, heat and leakage when starting machinery although these cannot be detected on the simulator

204

Exercise Title	Operation of plant machinery
Implementation	Start the simulation and let the trainees: (Start and stop emergency generator) - make procedures to start the emergency generator - check running parameters and voltage established - connect the generator to BUS line - disconnect the generator from BUS line - stop the generator (Start, stop and change over CSW pumps and LTFW pumps) - air purge in CSW pumps suction side - start No. 1 CSW pump checking pressure - change over No. 1 CSW to No.2 CSW pump in a correct manner - change over No. 2 CSW to No.3 CSW pump if any - set No. 1 CSW pump as a running pump and No. 2 and 3 to auto standby - open valves on No. 1 LTFW pump suction line and start No. 1 LTFW pump - open delivery valve of No.1 LTFW checking pressure - change over No. 1 LTFW pump to No.2 in a correct manner - change over No.2 LTFW pump to No.3 if any. - set No. 1 LTFW pump as a running pump and No.2 and 3 to auto standby (Start, stop and change over main air compressors) - open valves on LTFW line to No. 1 and 2 main air compressors (coolers) - open valves on compressed air line to No.1 main air reservoir from No.1 compressor - start No.1 main air compressors and supply No.1 main air reservoir with compressed air checking pressure and discharging drain manually - start No.2 main air compressor and supply No.1 main air reservoir with compressed air in parallel - after filling up No.1 main air reservoir, stop No.1 and 2 main air compressors and close supply valve to No. 1 main air reservoir - open supply valve to No.2 main air reservoir and start No.2 main air compressors to fill up No.2 main air reservoir - set No.2 main air compressor to auto - shut down No.1 main air compressor closing valves concerned in air and LTFW (Start and stop control air compressor) - same procedures as main air compressor and fill up control air reservoir with compressed air - set finally control air compressor to auto (Start, stop and change over diesel generators)

16

Exercise Title	Operation of plant machinery
	- open No.1 main air reservoir outlet valve - check No.1 diesel generator for CFW, LO and DO/FO - operation to start No.1 diesel generator opening valves concerned in CFW, LO and DO/FO - start No.1 diesel generator and confirm running parameters - connect No.1 diesel generator to Bus line confirming voltage and frequency on MSB - restart No.1 CSW pump and No.1 LTFW pump, and stop the emergency generator if necessary - check No.2 diesel generator for CFW, LO and DO/FO - operation to start No.2 diesel generator opening valves concerned in CFW, LO and DO/FO - start No.2 diesel generator and confirm running parameters - make manually parallel running of No.1 and 2 diesel generators on MSB - make manually single running of No.2 diesel generator ON MSB - stop No.1 diesel generator (Fire up auxiliary boiler and raise steam pressure including lining up steam system) - check water level of the boiler and feedwater/cascade tank for level - check the steam root valve closed and air vent valve opened - open valves concerned in DO supply line and start DO circulation - opened valves concerned in boiler water circulation line and start No. 1 boiler water circulation pump - set No.2 boiler water circulation pump to auto standby - operation for manually lighting off the burner - operation for extinguishing the flame about 1 minute later - operation for manually lighting off the burner about 1 minute later - repeat the same procedures one more time (The instructor makes the simulation faster at this stage in order to facilitate the training saying that the simulation runs faster although we must raise the steam pressure according to the specific standard for the boiler) - close air vent valve when the steam pressure reaches to 0.05 ~ 0.1 Mpa/0.5 ~ 1 bar - lighting off the burner accordingly again - line up the feed water line and start No. 1 feed water pump - supply feed water control system with control air if necessary - set No.2 feed water pump to auto standby. - stop No.1 boiler water circulation pump and close valves concerned - open steam supply valves on steam line when the steam pressure reaches to 0.4 Mpa/4 bar - start heating FO service tank, FO settling tanks and FO bunker tanks

Exercise Title	Operation of plant machinery
	- change fuel oil of the boiler from DO to FO and turn on FO heater when the temperature of FO service tank reaches to the setting valve - set the boiler to auto (Start, stop and changeover oil purifiers) - check No.1 FO purifier for operating water tank level and LO level - open valves concerned in FO and the operating water and start No.1 FO purifier - supply FO heater with heating steam - supply it with FO and checking running parameters when No. 1 FO purifier reaches to operational revolution speed - changeover No. 1 FO purifier to No. 2 FO purifier about 3 minutes later - check running parameters after changing over to No. 2 FO purifier - set No.2 FO purifier to automatic operation - stop No.1 FO purifier - check No.1 LO purifier for operating water level and LO level - open valves concerned in LO and the operating water and start No.1 LO purifier - supply LO heater with heating steam - supply it with LO when No.1 LO purifier reaches to operational revolution speed
Debriefing	Explain briefly the following - significance of correct sequence of starting and stopping machinery to avoid damage - theoretical aspects for sequence of starting and stopping machinery

Sample exercise-6

Exercise Title	**Diesel generator operation**
Task	Carry out starting, paralleling and changing over generators
Function and Level	Electrical, electronic and control engineering at the operational level
Competence	Operate electrical, electronic and control systems
Requirements (K.U.P.)	Basic configuration and operation principles of the following electrical, electronic and control equipment; .1 electrical equipment .b preparing, starting, paralleling and changing over generators
Outline of Training	The trainees perform the following operations on MSB; - starting and stopping remotely operated diesel generators - making parallel running of diesel generators automatically and manually - making single running of diesel generator automatically and manually - selecting priority of standby generators - setting optimum load sharing/number of generators Trainees stand in front of MSB and one trainee performs the operation in turn. Other trainees observe his/her performance. The instructor gives the trainee tasks to be done one by one. This operations should be performed by an individual trainee and the trainee should come to be well-versed in making parallel and single running of diesel generators
Initial Condition	In Port
Specific Purpose	The training allows the trainees to: - understand meaning of parallel running of generators - understand conditions for parallel running of generators - understand how to change over the generators
Briefing	Explain briefly the following - outline of the training - how to carry on the training - functions and arrangements of MSB - conditions to put a generator into service and to make parallel running of the generators - automations incorporated in the MSB for controlling generators - precautions to be observed when handling MSB
Implementation	Start the simulation and let the trainees: (Initial condition: In port and No. 1 diesel generator is in service and lets one trainee stand in front of MSB. The other trainees observe his/her performance from behind keeping a reasonable distance.) (Instruction 1) - start No.2 diesel generator remotely and make manually parallel running of No.1 and 2 diesel generators (Instruction 2) - make manually single running of No. 2 diesel generator and set No. 1 diesel generator to second standby/priority condition, stopping it remotely

Exercise Title	Diesel generator operation
	(Instruction 3) - start No. 3 generator remotely and make automatically parallel running of No.2 and 3 diesel generators (Instruction 4) - automatically stop No. 2 diesel generator making single running of No. 3 diesel generator and setting No. 2 diesel generator to second standby/priority condition (Instruction 5) - make full automatically single running of No. 1 diesel generator and set first standby/priority for No. 2 diesel generator and second standby/priority for No. 3 diesel generator (This is end of the first performance and the instructor lets the trainee change off to the next trainee. The training is kept up in the same manner until all the trainees complete performance however, operation patterns/combination may be changed by instructor's discretion)
Debriefing	Explain briefly the following - conditions necessary for making parallel running of generators - mistaken or misunderstanding if any during the performance - why parallel running is necessary - when parallel running is used - automations applied to generator control - functions incorporated in MSB relevant to automatic control of generators such as preference trip, large motor start blocking and others

"Sample exercise-7

Exercise Title	**Preparation of propulsion plant for departure port**
Task	Establish navigational mode
Function and Level	Marine engineering at the operational level
Competence	Operate main and auxiliary machinery and associated control systems
Requirements (K.U.P.)	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems .1 main engine and associated auxiliary
Outline of Training	trainees establish a group and the group performs, under the direction of the leader, operations of starting up main engine including warming up and establish navigational mode including starting up fresh water generator and turbo generator All operations should be principally carried out in manual.
Initial Condition	- In port
Specific Purpose	The training allows the trainees to: - acquire knowledge on procedures for starting up main diesel engine, fresh water generator, turbo generator and steam turbine and their procedural theories
Briefing	Explain briefly the following - outline of the training - how to carry on the training - purposes of warming up - meaning of navigational mode - significance to keep correct sequence of the procedures to prevent damage
Implementation	Start the simulation and let the trainees: (Main diesel engine) - carry out preparation for starting up - check the main engine for LO level, CFW expansion tank level and others - line up HTFW line using FW Heater - open the suction valve of No. 1 HTFW pump and start the pump - set No. 2 HTFW pump to auto standby - open delivery valve of No. 1 HTFW pump and confirm the pressure and temperature - commence warming up the main engine supplying FW Heater with heating steam - set setting value of FW temperature controller to appropriate level. - line up LTFW line for coolers concerning the main engine - line up LO line for the main engine, Turbo charger and Stern tube - start No. 1 LO pump/s and set No. 2 LO pump/s to auto standby - line up DO supply line - open suction and delivery valves of FO supply and FO booster pumps - start No. 1 FO supply pump and Booster pump confirming pressure and set No. 2 pumps to auto standby - check HTFW temperature

Exercise Title	Preparation of propulsion plant for departure port
	- check all indicator valves opened and engage turning gear - commence turning of the main engine by turning motor and check current vale - stop turning and disengage turning gear several minutes later - stop supply of heating steam to FW Heater and open bypass valve closing inlet and outlet valves when HTFW temperature reaches to the desired level - make parallel running of main air compressors - drain No. 1 and 2 main air reservoir - line up starting air line opening outlet valve of No. 1 main air reservoir - carry out start-up - carry out air running of the main engine with all indicator valves opened - close all indicator valves - manually start and stop the main engine several times within harbour speeds following engine orders - finally, set the engine speed to harbour full - increase manually the engine revolution until navigation speed after a while (Start and stop FWG) - line up ejector line and start ejector pump to establish vacuum inside the FWG - line up CSW line to the FWG - supply the FWG with feed water - supply Heater of the FWG with HTFW little by little when the vacuum reaches to the desired level - start distilled water pump opening supply line to filling tank when level of distilled water appears in the level gauge - check running parameters and opening of the HTFW temperature control valve - stop gradually supply of HTFW to Heater of FWG to avoid rapid change in temperature of HTFW - stop distilled water pump and close valves concerned - stop supply of feed water to Heater - stop supply of CSW to Condenser - stop the ejector pump and close valves concerned - slightly open vacuum breaker (Warming up, start and stop Turbo generator) - establish steam condenser system - establish Turbo generator (TG) LO system - establish TG steam system ensuring draining of steam and condensate lines

Exercise Title	Preparation of propulsion plant for departure port
	- supply TG with sealing steam by opening TG sealing steam supply valve - start No.1 condenser vacuum pump and set No. 2 to auto - start No.1 condensate pump and set No.2 pump to auto - carry out turning of TG by turning gear for several minutes - stop turning of TG - rest trip if any - start TG by slowly opening Emergency stop valve keeping low speed for about two minutes - increase revolution speed slowly until operational revolution speed - open TG Emergency stop valve to 100% - connect manually TG to BUS line on MSB - disconnect No. 1 diesel generator from Bus line manually - stop No.1 diesel generator manually - set No. 1 diesel generator to auto - change over power generation from TG to diesel generator - stop TG at several minutes later
Debriefing	Explain briefly the following - significance of correct sequence of starting and stopping machinery to avoid damage - theoretical aspects for sequence of starting and stopping machinery

Sample exercise-8

Exercise Title	**Routine pumping operations**
Task	Carry out pumping tasks
Function and Level	Marine engineering at the operational level
Competence	Operate fuel, lubrication, ballast and other pumping systems and associated control systems
Requirements (K.U.P.)	Operation of pumping systems; .1 routine pumping operations .2 operation of bilge, ballast and cargo pumping systems
Outline of Training	trainees establish a group and the group performs the following pumping operation in the engine room as routine pumping operations; - Transfer bunker oil to FO settling tanks - Transfer bilge, sludge, drain and separated oil - Send sea water for general use - Oily water separator operation The trainees may refer to a procedure manual prepared by instructors and all operations should be principally carried out in manual.
Initial Condition	- In port - Seagoing
Specific Purpose	The training allows the trainees to: - acquire knowledge on preparations and procedures for starting, operating and stopping pumping systems and - procedural theories of the pumping systems
Briefing	Explain briefly the following - outline and specific purpose of the training - how to carry on the training - procedures for starting and stopping pumps and their procedural theories applied to the systems - precautions to be observed when transferring fuel oil - significance to keep correct sequence of the procedures to prevent damage - needs to check running condition in terms of amperage, sounds, vibration, heat and leakage when starting the pumping systems - fill out oil record book with appropriate entries
Implementation (1st stage: In Port)	Start the simulation and let the trainees: (Transferring bunker oil) - transfer 5 m^3 of FO from No. 2 FO tank (P) to No. 1 FO settling tank using No. 1 FO transfer pump - transfer FO from No. 2 FO tank (S) to No. 2 FO settling tank until 90% in level using No. 2 FO transfer pump - transfer FO form No. 7 FO tank (C) to No. 1 FO settling tank using No. 1 FO transfer pump - transfer 20 m^3 of FO form No. 2 FO tank (P) to No. 2 FO tank (S) using No.1 and 2 transfer pump - transfer 0.1 m^3 of FO drain from FO drain tank to No. 1 FO settling tank using No. 1 FO transfer pump

Exercise Title	Routine pumping operations
	(Transferring bilge, sludge and others) - transfer bilge from engine room bilge well (P) to bilge tank using Bilge pump - transfer bilge from cargo hold to bilge tank using Bilge pump - transfer sludge form sludge tank to waste oil tank using Waste oil transfer pump - transfer separated oil from the tank to waste oil tank using Waste oil transfer pump - transfer drain from Drain tanks to Bilge tank using Bilge pump (Supply sea water for general use) - start Fire/General service pump and supply sea water to fire main adjusting pressure by opening overboard valve (This is end of the 1st stage and stop the simulation) Oily water separators (or similar equipment) requirements and operation
Implementation (2nd stage: Seagoing)	Start the simulation and let the trainees: (Operation of Oily water separator) - turn on oil content monitor - line up bilge overboard discharge line - open sea water suction and delivery valves of Oily water separator bilge pump system - start Oily water separator bilge pump and fill up the line and separator with sea water - change over the suction valve of the pump to bilge from bilge tank and discharge 0.5 m^3 of bilge - change over the suction valve of the pump to bilge from engine room bilge well until almost empty - change over the suction valve of the pump to sea water to replace bilge inside the system with sea water - stop the pump and close valves concerned - note transfer quantity for making entries in the Oil Record Book as per the latest IMO guidelines
Debriefing	Explain briefly the following - meaning of routine pumping operations - precautions for transferring heavy fuel oil - needs to pay due attention to level of FO tanks - purpose of bilge system and functions of tanks - differences between common bilge, direct bilge and emergency bilge - precaution for transferring bilge - features of pumps used for bilge systems

Sample exercise-9

Exercise Title	**Fault detection and measures**
Task	Address malfunction
Function and Level	Marine engineering at the operational level
Competence	Operate main and auxiliary machinery and associated control systems
Requirements (K.U.P.)	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems .1 main engine and associated auxiliaries .2 steam boiler and associated auxiliaries and steam systems .3 auxiliary prime movers and associated systems .4 other auxiliaries including refrigeration, air conditioning and ventilation systems
Outline of Training	trainees establish a group and the group performs operations to address malfunctions of the machinery assessing running parameters and conditions under the direction of the group leader The instructor selects malfunctions and may advise the trainees of procedures to be taken to address the malfunctions as necessary. Detail and specific procedures to be taken should be developed and prepared for the trainees according to specifications and functions of the simulator
Initial Condition	Seagoing and in port
Specific Purpose	The training allows the trainees to: - acquire knowledge on how to address malfunctions of machinery assessing running parameters and conditions
Briefing	Explain briefly the following - outline of the training - how to carry on the training - malfunctions and how to address the malfunctions
Implementation	Start the simulation and let the trainees perform operation to address the following malfunctions: (Engine room bilge well high level) - confirm the alarm by pressing buzzer stop and reset button - assess the conditions - prepare for starting bilge pump and transfer the bilge to bilge tank - (if there is no space in the bilge tank, discharge bilge in the bilge tank first and transfer the bilge to the bilge tank complying with the regulations concerned) - confirm the alarm indication becomes off (No. 1 FO settling tank low level) - confirm the alarm by pressing buzzer stop and reset button - assess the level, level of bunker tank in use, running parameter of FO transfer pump and status of valves concerned - take measures to increase the level - confirm the alarm indication becomes off (FWG high salinity)

Exercise Title	Fault detection and measures

	- confirm the alarm by pressing buzzer stop and reset button
	- assess value of salinity, distilled water level, HTFW temperature, opening of HTFW bypass valve, flow rate of feed water, vacuum, temperature of evaporation
	- adjust some of the running parameters to reduce the content of salinity
	- confirm the alarm indication becomes off
	(Auxiliary boiler low water level)
	- confirm the alarm by pressing buzzer stop and reset button
	- assess the level, opening of FWC valve, running parameters of feed water pump, cascade tank level, control parameters of FWC controller
	- take measures to increase the level.
	- confirm the alarm indication becomes off
	(No. 1 FO purifier abnormal separation)
	- confirm the alarm by pressing buzzer stop and reset button
	- assess running parameters of the FO purifier, resetting the purifier
	- decide measures to be taken from the results of assessment as follow
	  - take measures to manually resume the operation of the purifier
	  - take measures to stop the purifier and restart it as usual
	  - take measures to change over the purifier to No. 2 FO purifier
	- confirm the alarm indication becomes off
	(Auxiliary boiler flame failure)
	- confirm the alarm by pressing buzzer stop and reset button
	- changeover the boiler control to manual
	- start post purge
	- confirm causes of flame failure and take remedy actions
	  - flame eye
	  - FO low pressure/temperature
	  - low water level
	  - FDF abnormal stop
	  - power failure
	- reset combustion control
	- start pre-purge
	- light off the burner
	- changeover the boiler control to auto

Debriefing	Explain briefly the following - importance of detecting malfunction before alarm sounds - there are several proximate causes for one malfunction - needs to be well-versed in handling machinery to address malfunctions Explain briefly the following and let the trainees discuss them: - possible consequent incident in case of flame failure - importance of pre-purge and post purge - mechanism of boiler furnace blowback - safe procedures when faced with similar situations

Sample exercise-10

Exercise Title	**Engineering Watch**
Task	Maintain a safe engineering watch
Function and Level	Marine engineering at the operational level
Competence	Maintain a safe engineering watch
Requirements (K.U.P.)	Thorough knowledge of principles to be observed in keeping an engineering watch, including 1) duties associated with taking over and accepting a watch, 2) routine duties undertaken during a watch, 3) maintenance of the machinery space logs and the significance of the reading taken, 4) duties associated with handing over a watch.
Outline of Training	The trainees divided into two groups (A & B) and each group undertakes the engineering watch in turn. Roles of watch officer and ratings are assigned to the trainees of each group and the training is carried out in a manner of role playing. The each group performs watch duties as a team from an engine room round, taking over the watch, routine duties and handing over the watch
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - understand principles and procedures to be applied to the engineering watch - understand tasks to be done during watch period
Briefing	Instructor briefly explain: - outline of the training - how to carry on the training - roles of officer and ratings in the training as follow: the officer mainly; - figures out running condition of the propulsion plant as a whole - receives reports from persons in charge of the machinery - issues instructions of tasks to persons in charge of the machinery - makes entry of watch log at time of taking over the watch - briefs relieving watch personnel on information to be taken over the ratings mainly; - figure out the running condition of the machinery - fill out measurement tables of the machinery in charge - perform tasks instructed by the officer - report necessary information to the officer - follow instructions given by the officer
Implementation	Start simulation and let the group A take up the first position and let the trainees: (The group B observes performance being made by the group A in the briefing room) - make engine room round - (the watch officer of the group A) confirm all other ratings (other trainees) are ready to undertake the watch duties - receive transition briefing from the present watch officer (Instructor) - accept the watch if satisfied

Exercise Title	Engineering Watch
	- (the officer of the group A) instruct the ratings to carry out routine duties and to report the results (The following is an examples of routine duties) - periodical changeover of auxiliary machinery from No. 1/2 to No. 2/1 such as Fuel oil purifier, LO purifier, CSW pump, CFW pump, LO pump, Fuel oil booster pump and so on. - carrying out soot blowing for Auxiliary boiler and Exhaust gas economizer - carrying out blowing down Auxiliary boiler water - changing over generated fresh water supply tank - changing over fuel oil tank to be used - discharging the bilge water overboard through the oily-water separator - transferring bilge from bilge wells to bilge tank - discharging bilge of bilge tank overboard through oily water separator - incinerating waste oil - transferring fuel oil from bunker tanks to settling tanks - carrying out drainage from scavenging air manifold of the main engine, compressed air reservoirs and fuel oil settling tank and service tank - manual discharge of sludge on Fuel oil purifiers, LO purifiers if possible - test run of emergency fire pump and diesel generator - cleaning main engine turbocharger air and/or gas sides - (the officer) instruct the ratings to carry out an engine room round and to report the results (The following is an example of reporting main engine) - the engine load is now almost standard to the present revolution speed. - revolution speed of TC is also in standard range and highest exhaust gas temperature is 380 degree Celsius (℃), the lowest temperature is 335 degree Celsius (℃) - there is very little difference among all temperatures of CFW outlets at the standard value as well as Piston cooling LO and Bering LO. - opening of the HTFW temperature control valve is now 10% cooler side. - scavenging air temperature and pressure stay in standard values and pressure drop of the air in air coolers gets higher a little than previous watch records. - no malfunction was found and running condition of the engine is stable (All members of the group B1 enter the engine room and make an engine room round checking the running parameters indicated on the mimic panel, group starter panels, control stands and main engine manoeuvring stand) - The officer of the group A fills out the Engine Room Log Book to be handed over to the relieving watch personnel with information obtained

Exercise Title	Engineering Watch
	from his/her watchkeeping and the instructor as follow and prepares for handing over the watch. - sea water temperature; - engine room temperature; - ship's speed; - main engine average revolution speed; - fuel notch of main engine; - main engine output; - fuel oil consumption during the watch; - main engine exhaust gas highest and lowest temperatures; - turbocharger revolution speed; - tasks done; - tasks to be done during the relieving watch, if any; - instructions from C/E; and - information from the bridge (The instructor should give information relating to navigational conditions such as LOG distance, OG distance and so on.) (The members of group B enter the control room and both group A and B stand toe to toe) - The officer of group A gives orally all the member of group B transition briefing (The following is an example of the briefing) - the setting position of the main engine manoeuvring lever is Navigation Full and Fuel Notch is 50 - the last one hour average revolution of the main engine was 100 min-1 - the turbo generator is currently used and setting pressure of the boiler is 0.7 Mpa and damper control of the exhaust boiler is set to auto - sea water temperature is 20 degree Celsius and the engine room temperature is 35 degree Celsius - orders and/or instructions of Chief engineer, if the revolution of the main engine decrease until 95 min-1, report it to the Chief engineer since a heavy weather is likely expected. If there is special information from the bridge, report it to the Chief engineer - regular and/or additional tasks completed during the watch period - we carried out soot blowing for the exhaust boiler - we have changed over generated fresh water supply tank from No1 port FW tank to No 1 starboard FW tank - we have changed over fuel oil tank to be used from No. 3 Port FO tank to No.3 starboard FO tank - we discharged the bilge water from bilge tank overboard (This is completion of the 1st period. Alter the plant condition and start 2nd period letting the group B take up the first position in the same manner as the 1st period)

Exercise Title	Engineering Watch

Debriefing	Explain briefly the following
	- results of the training comparing to an actual engineering watch in terms of the following
	  - running conditions of the propulsion plant were satisfactory figured out
	  - reports to the leader were appropriate
	  - tasks during the watch were effective
	  - communications during the watch were sufficient
	- the instructor also emphasizes difference between the simulated engine room and an actual engine room and importance of engine room rounds as follow

189

Sample exercise-11

Exercise Title	**Change-over of remote/automatic to local control**
Task	Change over control systems of machinery from remote/automatic to local
Function and Level	Marine engineering at the operational level
Competence	Maintain a safe engineering watch
Requirements (K.U.P.)	Safety and emergency procedures; change-over of remote/automatic to local control of all systems.
Outline of Training	This training is conducted under ship's harbour full speed and the trainees perform the tasks to change-over the control positions of the specific machinery such as main engine, diesel generators, boilers, oil purifiers, air compressor and steering gear according to the situations.
Initial Condition	Harbour manoeuvring I speed
Specific Purpose	The training allows the trainees to get familiar with change-over of control position/mode from remote/automatic control to local control for the following machinery and operate the machinery manually - main engine - diesel generator - emergency diesel generator - steam boiler - oil purifier - air compressor - steering gear
Briefing	Explain briefly the following - outline of the training - how to carry on the training - roles of the trainees in charge of main engine, diesel generators, aux. boiler, purifier and steering gears - specific procedures to change over the control positions according to the specifications of the machinery
Implementation	Start the simulation and let the trainees perform: (main engine) - procedures to change over control position from the bridge to the control room - procedures to change over the control position from the control room to local - handle the main engine manoeuvring laver to control the engine speed responding to the telegraph orders from the bridge (instructor room) (diesel generator) - procedures to change over the control mode of No.1 generator to local control from automatic control - starting manually No. 1 generator - making manually parallel running of No.1 and No. 2 generators - procedures to change over the control mode of No.3 generator to local control from automatic control - starting manually No. 3 generator - making manually parallel running of No. 1, No. 2 and No. 3 generators

32

Exercise Title	Change-over of remote/automatic to local control
	- procedures to change over the control mode of No. 2 generator to local control from automatic control - removing manually No. 2 generator from the parallel running - stopping manually No. 2 generator - removing manually No. 1 generator from the parallel running - stopping manually No. 1 generator - procedures to change over the control mode of No. 3 generator to automatic control from local control - procedures to change over the control mode of No. 1 and No. 2 generators to automatic control from local control - select priority either No.1 or No. 2 generators as 1st standby generator (Air compressor) - procedures to change over the control mode of No.1 main air compressor to local/manual operation - starting and stopping manually No.1 compressor discharging drain accordingly - procedures to change over the control mode of No. 1 main air compressor to automatic operation (Steam boiler) - procedures to change over the control mode of auxiliary boiler to local/manual control from automatic control - lighting off manually the burner to raise the steam pressure starting with pre-purge - stopping manually combustion and carrying out post purge - procedures to change over the control mode to automatic control (Oil purifier) - procedures to change over the control mode of LO purifier to local/manual control - procedures for starting manually LO purifier - carrying out total de-sludging - procedures to change over the control mode to automatic control (Steering gear) - procedures to change over the control mode of steering gears to local/manual - taking manually rudder angle at Port, Starboard, Hard port, Hard starboard and Mid-ship - procedures to change over the control mode to remote control from local control
Debriefing	Explain briefly the following - precautions when changing over remote/automatic to local control, particularly when main engine is running in remote/automatic control - local controls or isolations of machinery are often used when starting up the plant from the port condition or cold condition

187

Sample exercise-12

Exercise Title	**Immediate actions to be taken in the event of fire or accident**
Task	Take measures to address fire or accident
Function and Level	Marine engineering at the operational level
Competence	Maintain a safe engineering watch
Requirements (K.U.P.)	Safety precautions to be observed during a watch and immediate actions to be taken in the event of fire or accident, with particular reference to oil systems
Outline of Training	This training is conducted by establishing urgent standby engine when the ship is on passage. The trainees receive request for urgent standby engine from the bridge due to an accident such as a fire, a person overboard, oil spill and others, and perform plant operation under direction of the watch officer assigned to one of the trainees to establish urgently state of standby engine from the state of passage.
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - understand how to address emergencies - understand a need for urgent standby engine under the emergencies - understand procedures for urgent standby engine
Briefing	Explain briefly the following - how to carry on the training - specific procedures to establish the state of standby engine being simulated - this training cannot be applied to an individual emergency event such as firefighting, flooding, rescue of over boarded person, and oil spill - In case of the person overboard, the main ,must be urgently stopped first and the propulsion plant will be brought to the standby condition The instructor should emphasize: - during a watch, the watch officer must address any situations - standby engine request must be issued from the bridge in almost all the cases - after the standby engine, the watch officer must address an individual situations - it is quite essential for the watch officer to always keep the propulsion plant under control in any cases since responses to the emergencies vary according to the situations - when the standby engine is requested, usually all hands must enter the engine room and the chief engineer must take an initiative according to the situations
Implementation	Start the simulation and let the trainees: (Fire: The training starts with phone call to the control room saying that we have a fire in the officer's accommodation and request urgent standby engine) - respond to standby engine by engine telegraph - start the fire pump and send extinguishing water to the fire main - turn off the electric power to the fire area - stop air conditioning system for the officer's accommodation

34

Exercise Title	Immediate actions to be taken in the event of fire or accident
	- start No.1 and No. 2 diesel generator and FO circulation of auxiliary boiler - change over the power source from the turbo generator to the diesel generators keeping the turbo generator in hot condition - stop FWG and make parallel running of main air compressors - start auxiliary boiler - change over the control position of the main engine to the control room and decrease engine speed to harbour full speed - inform the bridge of completion of preparation for standby engine (A person over-boarded: The training starts with phone call to the control room saying that the main engine was stopped suddenly at the bridge and "a person over board" will be announced and request urgent standby engine). - respond to standby engine by engine telegraph - start No.1 and No. 2 diesel generator and FO circulation of auxiliary boiler - change over the power source from the turbo generator to the diesel generators keeping the turbo generator in hot condition - stop FWG and make parallel running of main air compressors - start auxiliary boiler - change over the control position of the main engine to the control room - prepare for re-starting the main engine - inform the bridge of completion of preparation for standby engine - start the main engine responding to the telegraph order
Debriefing	Explain briefly the following - meaning of emergency situation such as a fire, a person over board, flooding, oil spill and others - responses to emergencies vary according to the situations - urgent standby engine must be requested in almost all the cases - specific preparations and procedures for urgent standby engine depend on specifications of the plant machinery - we must pay due attention to running parameters of the plant machinery however we sometimes have cases that we must ignore the range of running parameters/standards for the safety of lives even though it causes serious damage of the machinery As for response to individual emergency other than standby engine, the instructor lists measures to be taken by engine department in principle as follow: - A fire; - starting fire pumps, - cutting off power to the area - stopping ventilation fan and oil pumps - closing all outlet valves of oil tanks - preparing for all fire extinguishers - Oil spill

Exercise Title	Immediate actions to be taken in the event of fire or accident
	- preparing for oil dispersant - preparing for oil preventive appliances - A person over boarded; - preparing for a rescue boat - Flooding - starting bilge pump - discharging emergency bilge and direct bilge in case of engine room flooding

Sample exercise-13

Exercise Title	**Engine room Resource Management (ERM)**
Task	Practice ERM
Function and Level	Marine engineering at the operational level
Competence	Maintain a safe engineering watch
Requirements (K.U.P.)	Knowledge of engine room resource management principles including 1) allocation, assignment and prioritization of resources 2) effective communication, 3) assertiveness and leadership, 4) obtaining and maintaining situational awareness, 5) consideration of team experience
Outline of Training	This training aims at understanding ERM requirements through teamwork in operating plant machinery as parts of an engineering watch. Namely, process of plant operation is discussed and analysed in terms of the ERM requirements. For teamwork, roles of C/E, 2/E, 3/E and ratings are assigned to trainees accordingly and plant operation (leaving a port and recovery of blackout) is carried out under the direction of C/E. Communication system equipment must be used for communication between the instructor room, control room, and engine room during the training, and it is desirable to use English for communication. Instructor should prepare a procedure manual of plant operation from the port condition to the state of passage. The C/E of the group may refer to the manual as necessary during the training in order to issue his/her instructions to the other trainees (officers and ratings).
Initial Condition	1st stage: In port (One diesel generator is in service)
Specific Purpose	The training allows the trainees to: - demonstrate and understand ERM requirements as much as possible through two kinds of plant operation - discuss and analyse processes and activities made as a teamwork in operating plant machinery in terms of the ERM principles and requirements
Briefing - Leaving a port	Explain briefly the following: - outline of the training - how to carry on the training - roles of the C/E, 2/E, 3/E and ratings as follow; the C/E mainly, - figures out the running condition of the propulsion plant as a whole - receives reports from officers - issues instructions to officers the 2/E assists the C/E the 3/E and ratings; - figure out the running condition of the machinery in charge - perform tasks instructed by the C/E - report to the C/E necessary information - follow instructions issued by the C/E - Instructor should emphasize:

Exercise Title	Engine room Resource Management (ERM)
	- application of ERM requirements for the competence "Maintain a safe engineering watch" described in the Table III/1 is to maintain a safe engineering watch, exerting effective communication, leadership, situational awareness, assertiveness and effective utilization of personnel in various situations concerning the engineering watch. - meanings of effective communication, leadership, situational awareness and assertiveness - The communication includes instruction, answerback, report and dialogue and these communication patterns should be effectively carried out for maintaining the safe engineering watch.
Implementation - Leaving a port	Start the simulation (in port) and let the trainees take up the position assigned (Control room: C/E, 2/E, Engine room:3/E, Ratings) Use engine room resource management in principle and carry out closed loop communications (Proceeding for leaving a port) (Warming up the main engine) - line up ME CFW system and start No.1 HTFW pump - begin supply of warming up steam to ME - line up ME LO system and start No. 1 LO pump - line up FO supply system and start No.1 FO supply and booster pumps - line up stern tube LO system and start No.1 stern tube LO pump - start steering gear system and demonstrate its test run Steering gear test run: take the rudder angles "Port", "Starboard", "Hard port" and "Hard starboard" communicating with the bridge (Instructor room) - start ME turning and check current value of turning motor - start No.2 generator at engine side and report the running condition - make parallel running of diesel generators No.1 and No. 2 - switches on Bow thruster and Deck machinery (ME trial run at the control room) - stop supply of warming up steam - start No.1 boiler water circulation pump - make parallel running of main air compressors - stop ME turning and disengage ME turning gear - open starting air root valve of No.1 Air reservoir - make air running of ME - close all indicator valves - start auxiliary blowers and start ME in ahead direction - stop ME after several turns - start auxiliary blowers and start ME in astern direction - stop ME after several turns (Standby engine) - "Standby engine" is requested (telegraph gong sounds)

Exercise Title	Engine room Resource Management (ERM)
	- respond to the request - (after responding the request of standby engine, 2/E manoeuver the ME responding to telegraph orders) - "Full way engine" is requested - respond to the request - set manoeuvring lever to "Navigation" (Navigational condition) - make steering gear single run - make single run of diesel generator - begin warming up TG - line up circulation, condensate, gland steam and LO systems of TG - begin supply of gland steam, starting turning - make No.1 main air compressor single run - start ejector pump and prepare for starting FWG - start FWG after vacuum of FWG is established - start the turbo generator - change over electric power source to the turbo generator from diesel generator (This is completion of procedures from In port to state of passage and the instructor stop the simulation. The trainees move to the briefing room)
Debriefing	This is an intersessional debriefing, so the training should be simply reviewed from the aspects of ERM principles and the requirements and this review should be conducted in a form of Q and A as follow in order to let the trainees consider significance of teamwork. For the teamwork of leaving a port as a part of an engineering watch: - if allocations/arrangement of the personnel were appropriate - if assignments/roles and responsibility of the personnel were appropriate - if prioritization of the teamwork was appropriate - if utilization of information, equipment and personnel was effective - if functions of the equipment were satisfactory understood - if information was appropriately understood, responded and shared - if all communication patterns were clearly, effectively and timely carried out - if assertiveness was reflected - if leadership and situational awareness were exerted - if there was notification of any doubt - if there was consideration of team experience The instructor should emphasize the following, taking into account the aforementioned review. - when teamwork is necessary as parts of an engineering watch, personnel as a member of the team should understand their roles and responsibilities, and maintain effective communication in order to

Exercise Title	Engine room Resource Management (ERM)
	enhance performance of teamwork that contributes to a safe engineering watch - even if there were outstanding competent persons in the team, the teamwork does not always achieve higher performance - all the personnel therefore should be mindful on how we can build a good teamwork (Probably there is no correct answer, but better answer exists) - the aforementioned review must be reflected in the next stage of ERM training The instructor should conclude the debriefing saying that the idea of ERM or ERM requirements should be applied to all the duties on board ships although we have discusses ERM from the aspect of an engineering watch

ANNEXURE 2 Engine Room Simulator Specifications

Engine room simulator specifications have been referenced from ERS II of Appendix 2 of IMO Model Course 2.07 and must meet requirements of relevant sections of A-I/12 and B-I/12 of STCW Code.

Engine room simulator should consist of the following partitioned spaces equipped with appropriate equipment based upon the learning/assessment points.

- Engine room
- Control room
- Instructor room
- Briefing / Debriefing room

Engine room comprises the following:

- Mimic panel
- Main engine local control stand
- Pump panels/Group starter panels (GSPs)
- Auxiliary boiler control stand
- Purifier control stand
- Sound system equipment
- Communication system equipment
- Illumination system equipment

Control room comprises the following:

- Main console
- Main switch board (MSB)
- Communication system equipment
- Sound system equipment
- Illumination system equipment

Instructor room comprises the following:

- Instructor console
- Simulator control equipment
- Communication system equipment

Classroom / Briefing room comprises the following:

- Instructor and Trainees Briefing table and seating
- Exercise Replay feed
- Overhead projector and screen / monitor

A. Outline of engine room installations (Mimic panel)

- The latest and typical diesel engine propulsion plant is represented on the panel with its constructing machinery, piping diagrams and recommended accessories such as lamps, switches, meters and indicators.

(179)

– The panel must be designed based on the following ideas for effective training of plant operation and for better understanding of construction of the plant system:

(1) The panel should be such it would be possible for trainees to:
- observe the entire range of the panel from the appropriate position of the engine room and easy to identify what machinery comprises the propulsion plant;
- Identify mutual relationship of the machinery and actual arrangement of boiler, generator and other auxiliaries on board; and
- stay in control of running conditions and status of the propulsion plant.

(2) The panel should be designed with the intent to allow trainees to easily learn piping and systems. Accessories should be of appropriate size in relationship to the learning objectives.

The following is considered to be precautions to meet the ideas above:

(1) Sufficient clear space would be desirable to present entire system of the diesel engine propulsion plant in terms of size of illustrated machinery, presentation of piping diagrams and the idea (1) aforementioned.

(2) Piping systems representing cooling fresh water, fuel oil, lubricating oil and others should be illustrated in recognizable color code, width, length and arrangement as much as possible.

(3) Actual relativity between the machinery should be reflected in designing their shapes and sizes.

(4) The illustrated machinery should be drawn and arranged in an impressive manner as much as possible according to actual arrangement on board.

(5) Appropriate size and number of indication meters for pressure, temperature, level and control parameters should be fitted on the panel as necessary to allow trainees to observe the running conditions.

(Main engine control stand)
Main engine control stand is a desk type control stand equipped with main engine manoeuvring equipment, engine telegraph and communication system equipment.

(Pump panel/Group Starter Panel: GSP)
Pump panel/GSP is a panel equipped with starter panels of auxiliaries such as pumps, air compressors and purifiers.

(Auxiliary boiler control stand)
Auxiliary boiler control panel is a desk type control stand equipped with manual and automatic control equipment and available to remotely control the auxiliary boiler represented on the mimic panel.

(Purifier control stand)
Purifier control stand is a desk type control stand equipped with manual and automatic control equipment of FO, DO and LO purifiers and available to remotely control the purifiers represented on the mimic panel.

A2

(Sound system equipment)
A speaker of the sound system plays simulated engine room sounds according to running conditions of the propulsion plant while simulation is performed.

(Communication system equipment)
The main engine control stand should be equipped with communication system equipment which are microphone to communicate to the control and instructor rooms with speaker systems, speaker to sound messages from the control and instructor rooms to all persons in the engine room.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the engine room.

B. Outline of Control room Installations
(Main console)
The main console is a desk front type console equipped with main engine remote and automatic control panel, monitoring (Data logger) system and main auxiliary machinery control panel and others

(Main Switch Board: MSB)
The main switch board is dead front type panel equipped with recommended panels.

(Communication system equipment)
Microphone and speaker systems

(Sound system equipment)
A speaker of the sound system plays simulated control room sounds caused by operation of the propulsion plant.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the control room.

C. Outline of instructor room installations
(Instructor console)
The instructor console is a desk front type console equipped with simulator control equipment, communication system equipment, CCTV system equipment

(177)

(Simulator control equipment)
Simulator control equipment control various functions of the simulator consisting of the dedicated key board, monitor display and control unit

(Communication system equipment)
Microphone and speaker systems

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructor can observe the actions made by trainees in the engine and control room.

D. Outline of briefing / debriefing room
(Exercise Replay)
Projection / monitor to display exercise replay parameters, data logger system.

(Seating)
Table and chairs to seat 1 Instructor and 8 trainees

Engine room simulation equipment should be capable of simulating a main and auxiliary machinery system and incorporate facilities to:

1. create a real-time environment for seagoing and harbour operations, with communication devices and simulation of appropriate main and auxiliary propulsion machinery equipment and control panels;
2. simulate relevant sub-systems that should include, but not be restricted to, boiler, steering gear, electrical power general and distribution systems, including emergency power supplies, and fuel, cooling water, refrigeration, bilge and ballast systems;
3. monitor and evaluate engine performance and remote sensing systems;
4. simulate machinery malfunctions;
5. allow for the variable external conditions to be changed so as to influence the simulated operations: weather, ship's draught, seawater and air temperatures;
6. allow for instructor-controlled external conditions to be changed: deck steam, accommodation steam, deck air, ice conditions, deck cranes, heavy power, bow thrust, ship load;
7. allow for instructor-controlled simulator dynamics to be changed: emergency run, process responses, ship responses; and
8. provide a facility to isolate certain processes, such as speed, electrical system, diesel oil system, lubricating oil system, heavy oil system, seawater system, steam system, exhaust boiler and turbo generator, for performing specific training tasks.

ANNEXURE 3 - Sample certificate to be issued on successful completion of course

Institute's Logo

NAME and ADDRESS of the D. G. Approved Training Institution

MTI No: **Tel:** **Fax:** **E-mail:**

Certificate No:_____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth ..... (dd/mm/yyyy)

Holder of C.D.C. No. .....

Certificate of Competency / Proficiency, (if any) Grade: ..... No.....

Indian National Database of Seafarers (INDoS No.) .....

has successfully completed a training course in

ENGINE ROOM SIMULATOR (OPERATIONAL LEVEL)

held from..... to .....

The course is approved by Directorate General of Shipping (Vide letter ..... dated .....) and meets the requirements laid down in Section A-I/12 and B-I/12.73 and Table A-III/1 of the STCW Convention and Code 1978 as amended.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This Certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, and Government of India.

_____
Signature of Candidate

_____
Name, Indos No. and Signature of Course In-charge

Date of Issue:_____

Date of Expiry: UNLIMITED

Official Seal

Colour Photograph (35mm x 35mm)

_____
Name and Signature of Dean / Principal

Note :
1. All enquiries regarding this certificate should be addressed to the issuing authority al the address given above.

MANDATORY GUIDELINES FOR TRAINING INSTITUTES FOR OBTAINING APPROVAL FROM DIRECTORATE GENERAL OF SHIPPING

TO CONDUCT

ENGINE ROOM SIMULATOR COURSE FOR SECOND ENGINEER OFFICERS AT THE MANAGEMENT LEVEL ON SHIPS POWERED BY MAIN PROPULSION MACHINERY OF 3,000 KW PROPULSION POWER AND ABOVE

COURSE ID: 3211

To avoid unnecessary repetition, reference has been made herein to DG Shipping Training Manual (Training Circular 31 of 2018) wherever appropriate.

TABLE OF CONTENTS

Engine Room Simulator Course for Second Engineer Officers at the Management Level on ships powered by main propulsion machinery of 3,000 kW propulsion power or more

1.0 BASIC DETAILS OF THE COURSE

1.1. Aims:

This course covers the training recommended in the IMO Model Course 2.07 and fulfils the simulator training requirement for Second Engineer Officers at the Management Level, specified in Table A-III/2 of STCW Code as amended, to provide knowledge and skills related to operation, supervising and monitoring the safe operation and control of ship's machinery.

1.2. Objectives:

The trainee who successfully completes this course will have gained experienced in running, operation and maintenance of engine-room machinery under various conditions and will make a more effective contribution to the engine room team during normal and emergency situations.

In particular, the trainees will be able to have:

1.2.1 familiarization with the use of instrumentation and controls used in the engine rooms of modern merchant ships

1.2.2 an awareness of the need for proper pre-planning, the use of checklists and of the timescale involved in starting up propulsion plant machinery

1.2.3 experience in identifying operational problems and trouble-shooting

1.2.4 the ability of logical decision making which promotes operational safety

2.0 QUALIFICATION & ELIGIBILITY OF STUDENTS

2.1. Entry standards:

Prior to gaining entry into this course, the trainee should have:-

- MEO Class IV Certificate of Competency issued by Government of India
- Not less than twelve months as Assistant Engineer Officer or Officer in Charge of an Engineering Watch on ships powered by main propulsion machinery of 750 kW propulsion power or more, after obtaining MEO Class IV Certificate of Competency.

2.2. Required attendance:

100% attendance is required for successful completion of the course.

2.3. Course intake limitations:

The course intake shall be a maximum of 8 trainees divided into two teams. Depending on the facilities provided, one team would be carrying out an exercise while the other is being lectured, debriefed or planning the next exercise.

3.0 INFRASTRUCTURE REQUIREMENT :

Training centre's seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process. All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.

3.1 Engine Room Simulator

The Engine Room Simulator shall be type approved by DG Shipping on demonstrating its capability of fulfilling the requirements of Appendix 2 of IMO Model Course 2.07 Engine Room Simulator (2017 Edition)

Simulator Specifications: As per Annexure 2

3.2 Classroom

Class Room/Debriefing Room

As per DG Shipping Training Manual (Training Circular 31 of 2018)

4.0 COURSE DETAILS

4.1. Course Duration: 5 days (32 hrs)

4.2. Course Outline: As per given in Annexure 1

4.3. Course Certificate: As per format given in Annexure 3.

5.0 HOLIDAYS

5.1. Sundays shall be holidays.

5.2. Independence Day (15th August) and Republic Day (26th January) shall be compulsory holidays.

5.3. Students shall normally enjoy the holidays observed by the Govt. of the State in which the institute is located.

6.0 FACULTY REQUIREMENT

6.1 Qualifications and experience of course in charge:

Course In-charge shall :

- hold Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- have not less than 5 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course

6.2 Qualifications and experience of faculty members:

The faculty shall :

- Hold a Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- Have not less than 4 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course

6.3 Visiting faculty members:

Qualifications and experience of visiting faculty members should be the same as that of regular faculty as specified above.

6.4 All faculty members shall hold Training of Trainers & Assessors Course Certificate.(TOTA / VICT) (as per DGS Circular 26 of 2018, VICT course)

(172)

6.5 Age limit for regular faculty members:
As per Training Manual (Training Circular 31 of 2018)

7.0 FACULTY STRENGTH

7.1 Not less than two faculty, of which one is the course-in-charge. The Faculty: Trainee ratio shall be not more than 1:8 for theory sessions and 1:4 for simulation exercises.

7.2 Minimum of 50% of the entire portion must be covered by full time faculty. (As per DGS Order no. 5 of 2016).

8.0 COURSE DURATION
A total of 30 hours of lectures, including practical training and assessment.

9.0 ASSESSMENT
Assessment would be carried out at the end of each course.

10.0 QUALITY STANDARDS
As per Training Manual (Training Circular 31 of 2018)

11.0 INSPECTIONS
As per Training Manual (Training Circular 31 of 2018)

12.0 COST OF INSPECTIONS
As per Training Manual (Training Circular 31 of 2018 and Training Circular 29 of 2018)

13.0 FEES TO GOVT.
As per Training Manual (Training Circular 31 of 2018)

14.0 TEACHING AIDS

PUBLICATIONS:

IMO references (mandatory)

1. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, (STCW) 1978 as amended.
2. IMO model courses: 7.02 – Chief Engineer Officer and Second Engineer Officer
3. IMO model course: 2.07 – Engine Room Simulator – 2017 edition

Textbooks (mandatory)

1. Instruction books on operation of the simulator

Bibliography (non-mandatory)

B1: Taylor, D.A. Introduction to Marine Engineering. 2nd ed. London, Butterworth. 1990 (ISBN 07-50-6253-9)
B2: Diesel Engines for Ship Propulsion and Power Plants, Volume I & II. K. Kuiken Target Global Energy (ISBN 978-90-79104-02-4)
B3: Pounder's Marine Diesel Engines and Gas Turbines, 8th edition (ISBN 0-7506-5846-0)

49

B4: McGeorge H.D., Marine Auxiliary Machinery, Seventh Edition, Butterworth-Heinemann, 1995 (ISBN 0 7506 4398 6)

B5: Application of Automatic Machinery and Alarm Equipment in Ships; R. G. SMITH; Institute of Marine Engineers; (ISBN: 0900976152)

15.0 Course Outline and Simulator Exercises - As given in Annexure 1

16.0 Engine room simulator specifications - Annexure 2

17.0 Sample certificate to be issued on successful completion of course - Annexure 3

ANNEXURE – 1 COURSE OUTLINE

	Knowledge, understanding and proficiency (Learning Objectives)	Theory (Hours)	Simulation (Hours)
1.	**Familiarisation**	0.5	
1.1	Plant arrangements		1.0
1.2	Instrumentation		0.75
1.3	Alarm system		0.75
1.4	Control system		1.0
2.	**Operational procedures**	0.5	
2.1	Operation of plant machinery		3.0
2.2	Operate main and auxiliary machinery and systems		2.5
3.	**Maintain a safe engineering watch**		
3.1	Thorough knowledge of principles to be observed in keeping an engineering watch	1.0	
3.2	Safety and emergency procedures; change- over of remote/automatic to local control of all systems		1.5
3.3	Safety precautions to be observed during a watch		1.5
4.	**Function and mechanism of automatic control of main diesel engine**	1.0	
4.1	Automatic start of various machinery, main diesel engine load up programme, actuation of safety functions, automatic slow down and automatic shutdown.		3.0
5.	**Malfunction and Trouble-Shooting**	2.0	
5.1	Take remedy action to main engine malfunction		6.0
5.2	Other emergencies in engine room		6.0
	Total	**32 hrs**	

All times indicated above include briefing, debriefing and assessment.

SIMULATOR EXERCISES

Note: The values mentioned in the exercises are based on a particular type of engine. These values may vary depending on the type of engines being simulated. The instructor should accordingly set the values appropriate to the engine being simulated.

Sample exercise-1

Exercise Title	**Familiarization-1**
Task	Trace machinery and pipeline layout in the machinery space
Function and Level	Marine engineering at the management level
Outline of Training	Individual trainee works on tracing propulsion plant machinery and piping lines presented on the illustrating/mimic panel
Initial Condition	Not in operation
Specific Purpose	The training allows the trainees to: - understand how the propulsion plant is constructed - understand machinery systems which construct the plant - understand how the systems and machinery are connected - understand meaning/significance of piping lines
Briefing	Explain briefly the following This training gives understanding of construction of propulsion system and preliminary knowledge for plant operation Outline of the training - propulsion plant is mainly constructed by main machinery, power generation system, steam generation systems and other auxiliary machinery - the importance of understanding roles of these machinery systems and machinery which construct each system - a need to understand how these systems are connected by piping lines
Implementation	Let the trainees: - trace main machinery and its associated systems such as fuel supply, lubricating oil supply, cooling water circulation, air supply and exhaust gas systems with tanks, main valves, pumps, heaters and coolers - trace power generation system and its associated systems such as generators, prime movers, fuel supply/steam supply, cooling water circulation systems with tanks, main valves, pumps and coolers - trace steam generation system and its associated systems such as exhaust gas economizer, fuel supply, feed water, steam supply and condensate water systems with tanks, main valves, pumps, cooling water circulation, heaters and coolers - trace fuel transfer and treatment systems with tanks, main valves, pumps, purifiers and heaters - trance cooling fresh water and sea water systems with tanks, main valves, pumps, fresh water generator and coolers - trace compressed air systems with air compressors, air reservoirs and main valves, - trace lubricating oil treatment system with lubricating oil purifiers and

168

Exercise Title	Familiarization-1
	heaters - trace bilge treatment system with separator, incinerator, tanks, bilge wells, pumps and main valves - trace stern tube lubricating oil system with stern tube gravity tanks high and low, stern tube aft and fwd seal tanks, drain tank, pumps and cooler. - trace sewage plant system pipelines and connection to sea water system
Debriefing	Explain briefly the following - functions and features of piping lines - functions and features of tanks, particularly FW expansion tank - installations fitted on the piping lines and various types of valves and their correct operation. - differences between local control, remote control and automatic control - control methodologies applied to the machinery

53

Sample exercise-2

Exercise Title	**Familiarization-2**
Task	Operate instrumentation system to measure the running parameters of the main engine/auxiliary machinery
Function and Level	Marine engineering at the management level
Outline of Training	Individual trainee works on a check list reading indication meters of the simulated plant machinery on the mimic panel or illustrating panel and observing displays of instruments on the main console and main switch board
Initial Condition	Harbour transit
Specific Purpose	The training allows the trainees to: - get to know names and functions of instrumentations used to indicate running parameters and status of the plant machinery - understand difference between an analogue meter and digital indicator and their advantages and disadvantages - get familiar with reading indicators including unit - observe indicator diagrams displayed on the screen of an engine power meter or monitoring system
Briefing	Explain briefly the following This training gives understanding of instrumentation used in a ship's propulsion plant Outline of the training - various instrumentation is used to indicate various process values that are running parameters of the machinery - the importance of reading correctly these indications to ensure proper judgement of the running condition
Implementation	Start the simulation and let the trainees enter the engine room and: - start reading indications of various meters on the mimic panel or illustrating panel following the check list The instructor lets the trainees enter the control room and: - start reading indications of various meters on the main console and main switch board The instructor stops the simulation and creates standby engine as an initial condition and lets the trainees: - operate main engine manoeuvring lever in turn and observes p/v diagrams and draw curves of the main diesel engine on the display of monitoring system or engine power meter unit
Debriefing	Explain briefly the following - almost all running parameters can be seen on the display of monitoring system in an actual ship - actual thermometers, pressure gauges, level gauges and other process indicators are installed in an actual ship - usually there is a difference in indication values between actual meters and the monitoring system in an actual ship - the importance to remember approximate values of running parameters

166

Sample exercise-3

Exercise Title	**Familiarization-3**
Task	Operate alarm system used to indicate malfunctions and emergency
Function and Level	Marine engineering at the management level
Outline of Training	Individual trainee performs operation of alarm system identifying malfunction in turn
Initial Condition	Sea-going
Specific Purpose	The training allows the trainees to: - get to know difference between general alarm/emergency alarm and engine alarms - understand pattern of machinery alarms - understand how to respond to an alarm sound - meaning of alarm sound, lamp indications and lamp flicker - understand how to change alarm setting values - understand basic functions of monitoring system
Briefing	Explain briefly the following - how to respond to machinery alarms of instrumentation used in a ship's propulsion plant - basic functions of a monitoring system used for propulsion plant machinery - difference between general alarm and machinery alarms - meaning of buzzer stop button, reset/flicker stop button and alarm indication lamps
Implementation	Start the simulation and let the trainees: - perform buzzer test and lamp test in turn - respond to an alarm entered by the instructor - press buzzer stop button to stop the alarm sound - make sure what was alarmed and the malfunction machinery with lamp flicker - press reset/flicker stop button and make sure the lamp becomes continuous lighting - make sure the alarming value of parameter/status of the machinery - make sure that the alarm lamp lights until the alarmed parameter becomes normal - make sure that the alarm was recorded in the event printer/alarm printer with time of occurrence and stored in the monitoring systems until the alarmed parameter becomes normal (Instructor makes alarms one after another until the trainees become familiar with the response) - make changes in alarm setting value of running parameters for the monitoring system such as temperature, pressure, level and time-lag for alarming
Debriefing	Explain briefly the following - summary of the training - meanings of audible and visible alarm - an alarming system cannot be used in principle for a safety system

Exercise Title	Familiarization-3
	- three categories of alarm that are emergency alarm, primary alarm and secondary alarm

Sample exercise-4

Exercise Title	**Familiarization-4**
Task	Identify equipment used for controls
Function and Level	Marine engineering at the management level
Outline of Training	Individual trainee works on a check list for identifying equipment used for controls in the simulated propulsion plant
Initial Condition	Not in operation
Specific Purpose	The training allows the trainees to: - understand what machinery is remotely and/or automatically controlled - understand what process values are automatically controlled - identify what equipment is used for controls
Briefing	Explain briefly the following: - outline of the training - how to carry on the training - differences between remote control and automatic control - control methods applied to main machinery

Implementation	The instructor lets the trainees identify equipment used for controls following the check list:
	- remote-automatic control
	  - main engine control stand/panel in the engine room and control room
	  - main engine manoeuvring lever in the engine room and control room
	  - auxiliary blower control switch
	  - generator control panel on main switch board and main console
	  - synchronizing panel on main switch board
	  - auxiliary boiler control panel
	  - purifier control panel
	- remote control
	  - group starter panels (G.S.P.)
	- automatic control
	  - temperature controllers
	  - level controllers
	  - pressure controllers
	  - viscosity controllers
	  - control valves
	  - start and stop in group starter panels

Debriefing	Explain briefly the following - control methods applied to: actual main engine, power generation system and boiler controls - actual automatic control for temperature, level and other process values - actual automatic start and stop of auxiliary machinery

Sample exercise-5

Exercise Title	**Operation of plant machinery**
Task	Line up and establish auxiliary machinery systems
Function and Level	Marine engineering at the management level
Competence	Operate main and auxiliary machinery and associated control systems
Requirements (K.U.P.)	Preparation, operation, fault detection and necessary measures to prevent damage for the following machinery items and control systems .1 main engine and associated auxiliaries .2 auxiliary steam boiler and associated auxiliaries and steam systems .3 auxiliary prime movers and associated systems .4 other auxiliaries including refrigeration, air conditioning and ventilation systems
Outline of Training	Trainees establish a group and the group performs operations of the following machinery in the engine room; - start and stop emergency generator - start, stop and change over CSW pumps and LTFW pumps - start, stop and change over main air compressors - start and stop control air compressor - start, stop and change over oil purifiers The trainees may refer to a procedure manual prepared by instructors. All operations should be principally carried out in manual. This training is not for plant operation but for operation of each machinery, therefore same procedures may be sometimes repeated.
Initial Condition	Cold ship (FW, FO and LO are loaded, no machinery is in service, all valves are principally closed)
Specific Purpose	The training allows the trainees to: - understand how to start, stop and changeover auxiliary machinery - acquire knowledge on preparations and procedures for starting, operating and stopping machinery and their procedural theories
Briefing	Explain briefly the following - outline of the training - how to carry on the training - purposes of starting each machinery and establishing systems - procedures for starting, operating and stopping each machinery and their procedural theories applied to the machinery - significance to keep correct sequence of the procedures to prevent damage - needs to check running condition in terms of sounds, vibration, heat and leakage when starting machinery although these cannot be detected on the simulator

Exercise Title	Operation of plant machinery
Implementation	Start the simulation and let the trainees: (Start and stop emergency generator) - make procedures to start the emergency generator - check running parameters and voltage established - connect the generator to BUS line - disconnect the generator from BUS line - stop the generator (Start, stop and change over CSW pumps and LTFW pumps) - air purge in CSW pumps suction side - start No. 1 CSW pump checking pressure - change over No. 1 CSW to No.2 CSW pump in a correct manner - change over No. 2 CSW to No.3 CSW pump if any - set No. 1 CSW pump as a running pump and No. 2 and 3 to auto standby - open valves on No. 1 LTFW pump suction line and start No. 1 LTFW pump - open delivery valve of No.1 LTFW checking pressure - change over No. 1 LTFW pump to No.2 in a correct manner - change over No.2 LTFW pump to No.3 if any. - set No. 1 LTFW pump as a running pump and No.2 and 3 to auto standby (Start, stop and change over main air compressors) - open valves on LTFW line to No. 1 and 2 main air compressors (coolers) - open valves on compressed air line to No.1 main air reservoir from No.1 compressor - start No.1 main air compressors and supply No.1 main air reservoir with compressed air checking pressure and discharging drain manually - start No.2 main air compressor and supply No.1 main air reservoir with compressed air in parallel - after filling up No.1 main air reservoir, stop No.1 and 2 main air compressors and close supply valve to No. 1 main air reservoir - open supply valve to No.2 main air reservoir and start No.2 main air compressors to fill up No.2 main air reservoir - set No.2 main air compressor to auto - shut down No.1 main air compressor closing valves concerned in air and LTFW (Start, stop and change over diesel generators) - open No.1 main air reservoir outlet valve - check No.1 diesel generator for CFW, LO and DO/FO - operation to start No.1 diesel generator opening valves concerned in CFW, LO and DO/FO - start No.1 diesel generator and confirm running parameters - connect No.1 diesel generator to Bus line confirming voltage and

Exercise Title	Operation of plant machinery
	frequency on MSB - restart No.1 CSW pump and No.1 LTFW pump, and stop the emergency generator if necessary - check No.2 diesel generator for CFW, LO and DO/FO - operation to start No.2 diesel generator opening valves concerned in CFW, LO and DO/FO - start No.2 diesel generator and confirm running parameters - make manually parallel running of No.1 and 2 diesel generators on MSB - make manually single running of No.2 diesel generator ON MSB - stop No.1 diesel generator (Fire up auxiliary boiler and raise steam pressure including lining up steam system) - check water level of the boiler and feedwater/cascade tank for level - check the steam root valve closed and air vent valve opened - open valves concerned in DO supply line and start DO circulation - opened valves concerned in boiler water circulation line and start No. 1 boiler water circulation pump - set No.2 boiler water circulation pump to auto standby - operation for manually lighting off the burner - operation for extinguishing the flame about 1 minute later - operation for manually lighting off the burner about 1 minute later - repeat the same procedures one more time (The instructor makes the simulation faster at this stage in order to facilitate the training saying that the simulation runs faster although we must raise the steam pressure according to the specific standard for the boiler) - close air vent valve when the steam pressure reaches to 0.05 ~ 0.1 Mpa/0.5 ~ 1 bar - lighting off the burner accordingly again - line up the feed water line and start No. 1 feed water pump - supply feed water control system with control air if necessary - set No.2 feed water pump to auto standby - stop No.1 boiler water circulation pump and close valves concerned - open steam supply valves on steam line when the steam pressure reaches to 0.4 Mpa/4 bar - start heating FO service tank, FO settling tanks and FO bunker tanks - change fuel oil of the boiler from DO to FO and turn on FO heater when the temperature of FO service tank reaches to the setting valve - set the boiler to auto (Start, stop and changeover oil purifiers) - check No.1 FO purifier for operating water tank level and LO level

Exercise Title	Operation of plant machinery
	- open valves concerned in FO and the operating water and start No.1 FO purifier - supply FO heater with heating steam - supply it with FO and checking running parameters when No. 1 FO purifier reaches to operational revolution speed - changeover No. 1 FO purifier to No. 2 FO purifier about 3 minutes later - check running parameters after changing over to No. 2 FO purifier - set No.2 FO purifier to automatic operation - stop No.1 FO purifier - check No.1 LO purifier for operating water level and LO level - open valves concerned in LO and the operating water and start No.1 LO purifier - supply LO heater with heating steam - supply it with LO when No.1 LO purifier reaches to operational revolution speed
Debriefing	Explain briefly the following - significance of correct sequence of starting and stopping machinery to avoid damage - theoretical aspects for sequence of starting and stopping machinery

Sample exercise-6

Exercise Title	Operation of main propulsion and auxiliary machinery
Task	Start up, manoeuver and shutting/cooling down main engines
Function and Level	Marine engineering at the management level
Competence	Operation, surveillance, performance and maintaining safety of propulsion plant and auxiliary machinery
Requirements (K.U.P.)	Startup and shut down main propulsion and auxiliary machinery, including associated systems
Outline of Training	Trainees establish a group and the group performs starting up, operation and shutting/cooling down of main engines and each trainee manoeuvers the main engines responding to the telegraph order. The trainees may refer to a procedure manual prepared by instructors. (Specific procedures based on the simulated main engine should be developed and prepared for the trainees)
Initial Condition	In port (Completion of warming up)
Specific Purpose	The training allows the trainees to understand: - criteria for judgment of completing warming up and cooling done; - conditions for starting up; - checking point when main engines are started first for leaving a port; - various automatic controls applied to main engines; - operational procedures of main engines for starting up, navigational mode and shutting/cooling down main diesel engine; and - acquire skills on manoeuvring the main engine
Briefing	Explain briefly the following - outline of the training - how to carry on the training - operational procedures for warming up, starting up, setting up navigational mode and shutting/cooling down the main engine - criteria for judgment of completing warming up and cooling done - need for trial run of main engines when leaving a port - what should be checked during trial run of main engines

Implementation
(1st stage: warming up the main engine and leaving a port)
	Start the simulation and let the trainees demonstrate:
	(Main diesel engine)
	- check the main engine for completion of warning up including;
	  - level of LO sump tank
	  - FW expansion tank
	  - cylinder oil supply/daily tank
	  - circulations of CFW, LO and FO
	  - temperatures of CFW and LO
	  - setting values of controllers
	  - status of control system for the main engine
	- check auxiliary machinery for:
	  - stern tube LO sump tank
	  - status of main air compressors and pressure of air reservoirs
	  - status of steering gears
	  - status of power generation system

158

	- status of engine room fans - abnormal conditions if any - preparation for starting up the engine - disengage turning gear and all indicator valves are open - line up starting air - reset abnormal if any - notify startup of the main engine to the bridge (Instructor) - air running of the engine in the engine room confirming revolution indicator - closing all indicator valves - manual start and stop of the engine in ahead and astern slow in the engine room - changeover of the control position to the control room - remote-automatic start and stop of the engine in ahead and astern slow confirming: - starting and stopping auxiliary blower/s - rotation of the engine - timing of air cut - fuel notch (The instructor sets sub-telegraph to Standby Engine and issues 2 ~ 3 engine orders to the trainee for manoeuvring and creates some special conditions such as: - start failure - start impossible - wrong way - manoeuvring of the engine responding to the engine telegraph orders confirming: - automatic start and stop of auxiliary blowers - remote-automatic start and stop of the engine - timing of air cut - automatic revolution speed control - fuel notch - start failure - start impossible (The instructor issues Full way engine) - setting manoeuvring lever to the position of sea going/navigation full checking load up program activated - establishment of navigation mode including: - activation of speed run up/load up program - changeover of fuel oil to HFO from DO - automatic control of FO viscosity - single running of main air compressor - adjustment of scavenging air temperature - application of VIT and/or FQS
Implementation (2nd stage: entering a	Start the simulation and let the trainees demonstrate: (Diesel engine) - establishment of standby mode including:

63

port and shutting/cooling down the main engine)	- commencement of reducing engine speed - changeover fuel oil to DO when necessary - changeover of generator to diesel generator from turbo generator - stop of FWG - adjustment of FO viscosity, scavenging air temperature - parallel running of main air compressors and line up starting air supply line. (When the engine speed reaches to standby full speed, the instructor sets sub-telegraph to Standby engine and issues several engine orders) - manoeuvring the engine responding to the telegraph orders in remote-automatic control, checking running parameters (The instructor sets the sub-telegraph to "Finish with engine") - procedures for shutting down the engine including: - open all indicators valves. - changeover the control mode to manual and carry out air running for 1 ~ 2 rotations. - engage turning gear and commence turning of the engine providing the engine with cylinder oil. - shutting down auxiliaries stop No. 1 boiler water circulating pump and close valves concerned - close starting air line to the main engine and set main air compressors to single run - stop No. 1 FO pump and close valves concerned - stop the turning of the main engine - stop No. 1 stern tube LO pump and close valves concerned - stop the turning of the main engine - stop No. 1 LO pumps and close valves concerned - stop No. 1 HTFW LO pump confirming the temperature and close valves concerned - stop LO purifier
Debriefing	Explain briefly the following The instructor should brief on: - performance as a whole - procedural features of main diesel engines - important precautions to be observed by engineer officers at the management level when leaving and entering a port

156

Sample exercise-7

Exercise Title	Automatic control of main diesel engine
Task	Operate automatic start of auxiliary machineries, automatic speed control of main diesel engine, actuation of safety functions of main diesel engine
Function and Level	Electrical, electronic and control systems at the management level
Competence	Operate electrical, electronic and control systems
Requirements (K.U.P.)	1. Operation principles of the following control equipment: - Power management system diesel generators - Automatic start main engine luboil pump, jacket cooling water (JCW) pump, fuel oil booster pump, sea water pump in case of failure of running pumps - Automatic start of auxiliary boiler feed pump, fuel oil pump, exhaust gas economiser circulating pump 2. Operation principles of automatic speed control of main diesel engine by load up programme 3. Operation principles of actuation of safety functions of main diesel engine 4. Operating principles of automatic slowdown of main diesel engine 5. Operating principles of automatic shutdown of main diesel engine
Outline of Training	The trainees perform the following operations: 1. Starting and stopping remotely operated diesel generators 2. Making parallel running of diesel generators automatic 3. Selecting priority settings of standby generators 4. Setting optimum load sharing/number of generators 5. Setting and testing of remote/automatic control of main diesel engine luboil pump, JCW pump, Fuel oil booster pump, sea water pump 6. Setting and testing of remote/automatic control of auxiliary boiler feed pump, fuel oil pump and exhaust gas economiser circulating pump 7. Increase of speed of main diesel engine by load up programme 8. Operation of safety functions of main diesel engine and their bypass 9. Operation of automatic slowdown of main diesel engine 10. Operation of automatic shutdown of main diesel engine
Initial Condition	In port
Specific Purpose	The training allows the trainees to: 1. Understand power management system of diesel generators 2. Acquire knowledge on procedure of selecting and setting standby pumps of main diesel engine and boiler 3. Acquire knowledge automatic increase in rpm of main diesel engine by load up programme and its bypass in case of emergency

	4. Acquire knowledge of operation of safety system, auto slow down and auto shut down of main diesel engine and their bypass in case of emergency
Briefing	Explain briefly the following: - Outline of training - How to carry on the training - Significance to keep correct sequence of procedures to prevent damage - Demonstrate and understand settings and testing of standby diesel generators other auxiliaries. - Understand running conditions of propulsion plant as whole - Understand purpose of load up programme of main diesel engine while increasing its rpm and its benefits against manual increase of rpm - Understand purpose of safety system, auto slow down and auto shut down of main diesel engine and risks of bypassing auto shut down
Implementation (1st stage: Vessel in port and one diesel generator on load and main diesel engine warmed up and ready)	Start the simulation and let the trainees: - Put selector switch (auto/manual) of all diesel generators on auto - Put priority switch of non-running diesel generators on priority 1 & 2 - Set all non-running auxiliary pumps of main diesel engine and auxiliary boiler on standby First exercise: - Trainees trip the running generator from MSB and have a blackout. Observe priority no.1 generator starting and coming on load - In case sequential starting of electric motors (if installed in the simulators), trainees observe the motors start in sequence - Trainees start all other electric motors that have tripped due to blackout. Second exercise: - Trainees increase load on running generator by starting pumps and observe preferential trip taking place - Trainees observe priority no.1 generator starting and coming on load - Trainees reset preferential trip alarm switch and restart all motors that have tripped due to preferential trip Third exercise: - Trainees trip, one by one, running motors of main diesel engine luboil pump, JCW pump, fuel oil booster pump, sea water pump, auxiliary boiler feed pump, fuel oil pump and exhaust gas economiser circulating pump - Trainees observe standby pumps starting and pressures and temperatures in the system normalize

	This is end of the 1st stage and the instructor stops the simulation.
Implementation (2nd stage: vessel leaving a port and full away given on telegraph)	- Trainees activate load up programme of main diesel engine - Trainees increase fuel lever setting of main diesel engine - Trainees observe gradual increase of all parameters of main diesel engine including rpm, exhaust gas temperature, scavenge air pressure, turbocharger rpm, torque of propeller shaft (if fitted in simulator) This is end of the 2nd stage and the instructor stops the simulation.
Implementation (3rd stage: vessel at sea)	- Trainees increase set temperature of JCW and till JCW high temperature alarrn is activated - Trainees observe main diesel engine auto slow down alarm activation and auto slowdown of rpm of main engine - Trainees bring telegraph to dead slow ahead, reset the temperature of JCW to earlier setting. When JCW outlet temperature normalises and alarm gets deactivated, trainees increase the fuel lever gradually to earlier setting This is end of the 3rd stage and the instructor stops the simulation.
Implementation (4th stage: vessel at sea)	- Trainees set main engine standby luboil pump to manual and trip running luboil pump - Trainees observe main engine luboil low pressure alarm gets activated and main engine auto shut down alarm gets activated and main engine rpm starts reducing - Trainees bring the telegraph to stop - Trainees restart the luboil pump and put the second luboil pump on standby - When luboil pressure becomes normal and alarm gets deactivated, trainees gradually increase fuel lever to earlier setting This is end of the 3rd stage and the instructor stops the simulation.
Debriefing	Explain briefly the following: - Power management system diesel generators - Automatic start main engine luboil pump, jacket cooling water (JCW) pump, fuel oil booster pump, sea water pump in case of failure of running pumps - Automatic start of auxiliary boiler feed pump, fuel oil pump, exhaust gas economiser circulating pump - Operation principles of automatic speed control of main diesel engine by load up programme - Operation principles of actuation of safety functions of main diesel engine - Operating principles of automatic slowdown of main diesel engine - Operating principles of automatic shutdown of main diesel engine

Sample exercise-8

Exercise Title	Main engine malfunction
Task	Take remedy action to main engine malfunction
Function and Level	Maintenance and repair at the management level
Competence	Detect and identify the causes of main diesel engine malfunctions and correct faults
Requirements (K.U.P.)	Detection of machinery malfunction, location of faults and action to prevent damage
Outline of Training	Trainees establish a group and the group takes remedy action to the following malfunctions to prevent damage under the direction of the group leader: - automatic slowdown by thrust bearing high temperature - high oil mist condition in main engine crank case - main engine under piston space temperature high - main engine governor failure - leaking exhaust valve - blow-by (broken/worn out piston rings, worn out liner - main engine one unit not firing - main engine one unit liner cracked
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - acquire knowledge on how to address main engine malfunctions in accordance with situations - understand meanings and possible causes of the malfunctions - understand what is necessary to avoid such cases
Briefing	Explain briefly the following - outline of the training - how to carry on the training - how to address the malfunctions

Implementation (1st stage)	(Main engine automatic slowdown by Thrust bearing high temperature)
	Start the simulation and let the trainees:
	- confirm that the plant condition is in good order
	The instructor enters thrust bearing high temperature and the trainees:
	- confirm main engine automatic slow down with the alarm sound by pressing buzzer stop and reset button
	- take make immediately procedures to changeover the power generation system to No. 1 diesel generator from Turbo generator, keeping Turbo generator in a hot condition
	- start urgently auxiliary boiler and stop FWG accordingly
	- assess quickly main running parameters of the main engine
	- take measures to changeover control position of the main engine to the control room from the bridge, keeping the revolution speed at Slow ahead and notifying the main engine automatic slow down to the bridge.
	- locate proximate cause of the automatic slowdown checking running parameters as follow or get to know alarming point
	  - LO temperature of the thrust bearing
	  - LO pressure
	  - LO flow rate

	- LO temperature control valve - control parameters of LO temperature controller - trouble of LO pumps - clogged LO strainer - fouled LO cooler - carry out remedy actions operations to recover the running condition - reset the abnormal and make procedures to resume the operation of the main engine - increase the engine speed by setting the manoeuvring lever to the position as it was - make procedures to changeover the power generation system to Turbo generator from No. 1 diesel generator as the speed is resumed - restart FWG and stop auxiliary boiler - confirm that the plant condition is resumed This is end of the 1st stage and the instructor stops the simulation
Implementation (2nd stage)	(High oil mist condition in main engine crank case) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters bearing high temperature and the trainees: - confirm the bearing high temperature alarm by pressing buzzer stop and reset button - check oil mist detector for readings and find the section unit where the bearing high temperature occurred - request immediate engine stop informing the bridge of the situation - start standby diesel generator and changeover the power generation system to the diesel generator from the turbo generator - make the engine speed slow instantly - stop heating of fresh water generator stopping distilled water pump - start auxiliary boiler and establish the standby condition of the propulsion plant - stop the main engine - open all indicator valve and carry out air running - start turning of the engine by turning motor for cool down and inspection This is end of 2nd stage and the instructor stops the simulation.
Implementation (3rd stage)	(Fire in under piston/scavenging space) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters piston ring leaking and the trainees: - aware of rising under piston space temperature - request immediate engine stop informing the bridge of much higher temperature of under piston space than usual - start standby diesel generator and changeover the power generation system to the diesel generator from the turbo

	generator - make the engine speed slow instantly - stop heating of fresh water generator stopping distilled water pump - start auxiliary boiler and establish the standby condition of the propulsion plant - stop the main engine - open all indicator valve and carry out air running - start turning of the engine by turning motor for inspection This is end of the 3rd stage and the instructor stops the simulation.
Implementation (4th stage)	(Main engine governor failure) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters main engine governor failure and the trainees: - confirm governor failure alarm by pressing alarm buzzer stop - observe main engine slows down and stops - main engine does not respond to fuel lever from ECR - inform the bridge of the situation - disengage the governor - change over to engine side control - restart the main engine from engine side control - gradually increase speed and control speed from engine side control - inform the bridge of the situation is under control and bridge control is unavailable - arrange for watch keeping in engine room This is end of the 4th stage and the instructor stops the simulation.
Implementation (5th stage)	(Leaking exhaust valve of one unit of main diesel engine) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters leaking exhaust valve in one unit of main engine and the trainees: - confirm the main engine exhaust gas temperature deviation alarm by pressing buzzer stop - check exhaust gas temperature of all units and find the unit where the high temperature has occurred - observes drop in peak pressure and compression pressure of that unit - concludes that possible reason could be leaking exhaust valve of the unit This is end of the 5th stage and the instructor stops the simulation.
Implementation (6th stage)	{Blow-by (broken/worn out piston rings, worn out liner) of one unit of main diesel engine)} Start the simulation and let the trainees: - confirm that the plant condition is in good order

	The instructor enters blow-by of one unit and the trainees: - confirm scavenge space high temperature deviation alarm of by pressing buzzer stop - confirm reduction in exhaust gas temperature of one unit - confirm reduction in peak pressure and compression pressure of that unit - confirm increase in scavenge space pressure and temperature - conclude blow-by of piston rings of that unit This is end of the 6th stage and the instructor stops the simulation.
Implementation (7th stage)	(Main engine one unit not firing) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters main engine one unit not firing and the trainees: - confirm the main engine exhaust gas temperature deviation alarm by pressing buzzer stop - observe exhaust gas temperature of one unit of main engine to be very low - observe peak pressure of that unit has dropped to compression pressure - conclude that particular unit of main engine not firing. - plan remedial action This is end of the 7th stage and the instructor stops the simulation.
Implementation (8th stage)	(main engine one unit liner cracked) Start the simulation and let the trainees: - confirm that the plant condition is in good order The instructor enters the fault main engine one unit liner cracked and the trainees: - confirm main engine expansion tank low level alarm by pressing buzzer stop - maintain expansion level by taking fresh water - confirm scavenge space high level alarm by pressing buzzer - observe exhaust gas temperature lower than before - observe fluctuation in JCW pump discharge pressure and fluctuation in current drawn by JCW pump motor - conclude leakage of JCW in that particular unit of main engine - decide to stop main engine after informing bridge for opening of unit for internal inspection This is end of the 7th stage and the instructor stops the simulation.
Debriefing	Explain the reasons, possible damage to machinery and, human life and timely rectification for following faults of main engine: - thrust bearing high temperature - high oil mist condition in main engine crank case - main engine under piston space temperature high

	- main engine governor failure - leaking exhaust valve - blow-by (broken/worn out piston rings, worn out liner - main engine one unit not firing - main engine one unit liner cracked

(148)

Sample exercise-9

Exercise Title	Other emergencies in engine room
Task	Diagnose the causes other emergencies in engine room and take remedial measures
Function and Level	Maintenance and repair at the management level
Competence	Detect and identify the causes of emergencies in engine room and correct faults
Requirements (K.U.P.)	Detection of machinery malfunction, location of faults and action to prevent damage
Outline of Training	Trainees establish a group and the group takes remedy action to the following malfunctions to prevent/minimize damage under the direction of the group leader: - exhaust gas economizer fire - engine room flooding - engine room fire
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - understand how to address engine room emergencies - diagnoses the causes of these emergencies - discuss remedial measures to taken to overcome these emergencies - discuss how to prevent these emergencies
Briefing	Explain briefly the following - how to conduct the training and positions assigned to the trainees - running conditions of the main engine - how the following occur (i) exhaust gas economizer fire (ii) engine room flooding (iii) engine room fire - how above are detected - how above emergencies are tackled in timely and effective manner
Implementation 1st stage	(Exhaust Gas Economizer Fire) Start the simulation and let the trainees: - confirm that the plant and engine room condition is in good order Instructor enters the malfunction of fire in exhaust gas economizer and the trainees: - confirm occurrence of the fire in exhaust gas economizer detected with high temperature alarm of exhaust gas economizer outlet - stop the main engine as soon as possible after informing bridge of the situation - start standby diesel generator and change power generation system to the diesel generator from turbo generator - stop heating of fresh water generator stopping distilled water pump - start auxiliary boiler and establish the standby condition of the propulsion plant - check the following keeping turbo generator and fresh water generator in idling: - temperature of exhaust gas economizer gas outlet

23

	- steam pressure - boiler water circulation pump pressure - auxiliary boiler feedwater flow rate - cascade tank level - when the temperature of exhaust gas economizer gas outlet goes down, keep the economizer as it is for a while to dry up - if no abnormality is found, start preparation for restart of the main engine - start the main engine informing the bridge - resume the plant conditions as they were, after the engine speed reaches to the navigation speed This is end of the 1st stage and the instructor stops the simulation.
Implementation 2nd stage	(Engine room flooding) Start the simulation and let the trainees: - confirm that the plant condition is in good order Instructor enters the malfunction of bilge high level in the engine room and the trainees: - confirm engine room bilge high level by pressing the buzzer stop - confirm engine room bilge level high by visual inspection - decide to pump out the engine room bilge overboard through emergency bilge injection valve - inform bridge of the situation in engine room and decision to pump out engine room bilges overboard directly - relevant entries are made in engine room log book and Oil Record Book (Part II) - after engine room bilge water level is brought under control, source of heavy leakage of sea water is located (main sea water pipe line has a hole) - decision is made to cement box same - bridge informed and main engine is stopped - emergency generator is started and running diesel generators are stopped - all sea water inlet valves to/from sea are closed This is end of the 2nd stage and the instructor stops the simulation.
Implementation 3rd stage	(Engine room fire) Start the simulation and let the trainees: - confirm that the plant condition is in good order Instructor enters the malfunction of fire on top of running diesel generator and the trainees: - confirm fire in engine room by pressing the buzzer stop - bridge (instructor) informs fire on top of generator no. 1 - no.1 generator hypermist activated - standby diesel generator started and taken on load - no.1 generator stopped - evaluate damage to generator by fire This is end of the 3rd stage and the instructor stops the simulation.
Debriefing	Explain briefly the following - summary of the training

	- need to keep exhaust gas economizer clean from inside - need for good round of all sea water pipelines and rectification of smallest leak before they become big - need to keep all fuel oil pipelines in good condition - need to keep all fire detection alarms in good working condition - need to keep all fire fighting equipment in ready condition

Annexure 2

Engine Room Simulator Specifications

Engine room simulator specifications have been referenced from ERS II of Appendix 2 of IMO Model Course 2.07 and must meet requirements of relevant sections of A-I/12 and B-I/12 of STCW Code.

Engine room simulator should consist of the following partitioned spaces equipped with appropriate equipment based upon the learning/assessment points.

- Engine room
- Control room
- Instructor room
- Briefing / Debriefing room

Engine room comprises the following:

- Mimic panel
- Main engine local control stand
- Pump panels/Group starter panels (GSPs)
- Auxiliary boiler control stand
- Purifier control stand
- Sound system equipment
- Communication system equipment
- Illumination system equipment

Control room comprises the following:

- Main console
- Main switch board (MSB)
- Communication system equipment
- Sound system equipment
- Illumination system equipment

Instructor room comprises the following:

- Instructor console
- Simulator control equipment
- Communication system equipment

Classroom / Briefing room comprises the following:

- Instructor and Trainees Briefing table and seating
- Exercise Replay feed
- Overhead projector and screen / monitor

A. Outline of engine room installations
(Mimic panel)

(144)

- The latest and typical diesel engine propulsion plant is represented on the panel with its constructing machinery, piping diagrams and recommended accessories such as lamps, switches, meters and indicators.

- The panel must be designed based on the following ideas for effective training of plant operation and for better understanding of construction of the plant system:

(1) The panel should be such it would be possible for trainees to:
   - observe the entire range of the panel from the appropriate position of the engine room and easy to identify what machinery comprises the propulsion plant;
   - Identify mutual relationship of the machinery and actual arrangement of boiler, generator and other auxiliaries on board; and
   - stay in control of running conditions and status of the propulsion plant.

(2) The panel should be designed with the intent to allow trainees to easily learn piping and systems. Accessories should be of appropriate size in relationship to the learning objectives.

The following is considered to be precautions to meet the ideas above:

(1) Sufficient clear space would be desirable to present entire system of the diesel engine propulsion plant in terms of size of illustrated machinery, presentation of piping diagrams and the idea (1) aforementioned.

(2) Piping systems representing cooling fresh water, fuel oil, lubricating oil and others should be illustrated in recognizable color code, width, length and arrangement as much as possible.

(3) Actual relativity between the machinery should be reflected in designing their shapes and sizes.

(4) The illustrated machinery should be drawn and arranged in an impressive manner as much as possible according to actual arrangement on board.

(5) Appropriate size and number of indication meters for pressure, temperature, level and control parameters should be fitted on the panel as necessary to allow trainees to observe the running conditions.

(Main engine control stand)

Main engine control stand is a desk type control stand equipped with main engine manoeuvring equipment, engine telegraph and communication system equipment.

(Pump panel/Group Starter Panel: GSP)

Pump panel/GSP is a panel equipped with starter panels of auxiliaries such as pumps, air compressors and purifiers.

(Auxiliary boiler control stand)

Auxiliary boiler control panel is a desk type control stand equipped with manual and automatic control equipment and available to remotely control the auxiliary boiler represented on the mimic panel.

(Purifier control stand)

Purifier control stand is a desk type control stand equipped with manual and automatic control equipment of FO, DO and LO purifiers and available to remotely control the purifiers represented on the mimic panel

(Sound system equipment)
A speaker of the sound system plays simulated engine room sounds according to running conditions of the propulsion plant while simulation is performed.

(Communication system equipment)
The main engine control stand should be equipped with communication system equipment which are microphone to communicate to the control and instructor rooms with speaker systems, speaker to sound messages from the control and instructor rooms to all persons in the engine room.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the engine room.

B. Outline of Control room Installations
(Main console)
The main console is a desk front type console equipped with main engine remote and automatic control panel, monitoring (Data logger) system and main auxiliary machinery control panel and others

(Main Switch Board: MSB)
The main switch board is dead front type panel equipped with recommended panels.

(Communication system equipment)
Microphone and speaker systems

(Sound system equipment)
A speaker of the sound system plays simulated control room sounds caused by operation of the propulsion plant.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the control room.

C. Outline of instructor room installations

(142)

(Instructor console)
The instructor console is a desk front type console equipped with simulator control equipment, communication system equipment, CCTV system equipment

(Simulator control equipment)
Simulator control equipment control various functions of the simulator consisting of the dedicated key board, monitor display and control unit

(Communication system equipment)
Microphone and speaker systems

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructor can observe the actions made by trainees in the engine and control room.

D. Outline of briefing / debriefing room
(Exercise Replay)
Projection / monitor to display exercise replay parameters, data logger system.

(Seating)
Table and chairs to seat 1 Instructor and 8 trainees

Engine room simulation equipment should be capable of simulating a main and auxiliary machinery system and incorporate facilities to:

1. create a real-time environment for seagoing and harbour operations, with communication devices and simulation of appropriate main and auxiliary propulsion machinery equipment and control panels;
2. simulate relevant sub-systems that should include, but not be restricted to, boiler, steering gear, electrical power general and distribution systems, including emergency power supplies, and fuel, cooling water, refrigeration, bilge and ballast systems;
3. monitor and evaluate engine performance and remote sensing systems;
4. simulate machinery malfunctions;
5. allow for the variable external conditions to be changed so as to influence the simulated operations: weather, ship's draught, seawater and air temperatures;
6. allow for instructor-controlled external conditions to be changed: deck steam, accommodation steam, deck air, ice conditions, deck cranes, heavy power, bow thrust, ship load;
7. allow for instructor-controlled simulator dynamics to be changed: emergency run, process responses, ship responses; and
8. provide a facility to isolate certain processes, such as speed, electrical system, diesel oil system, lubricating oil system, heavy oil system, seawater system, steam system, exhaust boiler and turbo generator, for performing specific training tasks.

29

141

ANNEXURE 3 - Sample certificate to be issued on successful completion of course

Institute's Logo

NAME and ADDRESS of the D. G. Approved Training Institution

MTI No: **Tel:** **Fax:** **E-mail:**

Certificate No:_____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth ..... (dd/mm/yyyy)

Holder of C.D.C. No. .....

Certificate of Competency / Proficiency, (if any) Grade: ..... No.....

Indian National Database of Seafarers (INDoS No.) .....

has successfully completed a training course in

ENGINE ROOM SIMULATOR
(MANAGEMENT LEVEL – SECOND ENGINEER OFFICER)

held from..... to .....

The course is approved by Directorate General of Shipping (Vide letter ..... dated .....) and meets the requirements laid down in Section A-I/12 and B-I/12.73 and Table A-III/1of the STCW Convention 1978 as amended.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This Certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, and Government of India.

_____
Signature of Candidate

_____
Name, Indos No. and Signature of Course In-charge

Date of Issue:_____

Date of Expiry: UNLIMITED

Official Seal

Colour Photograph (35mm x 35mm)

_____
Name and Signature of Dean / Principal

Note :
1. All enquiries regarding this certificate should be addressed to the issuing authority al the address given above.

80

MANDATORY GUIDELINES FOR TRAINING INSTITUTES FOR OBTAINING APPROVAL FROM DIRECTORATE GENERAL OF SHIPPING

TO CONDUCT

ENGINE ROOM SIMULATOR COURSE FOR MEO CLASS 1 OFFICERS AT THE MANAGEMENT LEVEL ON SHIPS POWERED BY MAIN PROPULSION MACHINERY OF 3,000 KW PROPULSION POWER AND ABOVE

COURSE ID: 3221

To avoid unnecessary repetition, reference has been made herein to DG Shipping Training Manual (Training Circular No. 31 of 2018) wherever appropriate.

TABLE OF CONTENTS

Engine Room Simulator Course for MEO Class 1 Officers at the Management Level on ships powered by main propulsion machinery of 3,000 kW propulsion power or more

1.0 BASIC DETAILS OF THE COURSE

1.1. Aims:

This course covers the training recommended in the IMO Model Course 2.07 and fulfils the simulator training requirement for Chief Engineer Officers at the Management Level, specified in Table A-III/2 of STCW Code as amended, to provide knowledge and skills related to optimisation of fuel consumption, supervising and monitoring the combustion parameters for safe and efficient operation and control of ship's machinery.

1.2. Objectives:

The trainee who successfully completes this course will have gained experienced in running, operation and maintenance of engine-room machinery under various conditions and will make a more effective contribution to the engine room team during normal and emergency situations.

In particular, the trainees will be able to have:

1.2.1 familiarization with the use of instrumentation and controls used in the engine rooms of modern merchant ships

1.2.2 an awareness of the need for proper pre-planning, the use of checklists and of the timescale involved in starting up propulsion plant machinery

1.2.3 experience in identifying operational problems and trouble-shooting

1.2.4 the ability of logical decision making which promotes operational safety

1.2.5 the ability to get best specific fuel oil consumption (SFOC) for a given grade of fuel and load of main diesel engine, keeping all parameters of engine in safe limits

2.0 QUALIFICATION & ELIGIBILITY OF STUDENTS

2.1. Entry standards:

Prior to gaining entry into this course, the trainee should have:-

- MEO Class II Certificate of Competency issued or recognised by Government of India
- Sea time requirements as per TABLE III/16-1 of Section III/16 of Training, Examination and Assessment Programme (TEAP) – Part A

2.2. Required attendance:

100% attendance is required for successful completion of the course.

2.3. Course intake limitations:

The course intake shall be a maximum of 8 trainees divided into two teams. Depending on the facilities provided, one team would be carrying out an exercise while the other is being lectured, debriefed or planning the next exercise.

3.0 INFRASTRUCTURE REQUIREMENT

Training centre's seeking approval will need to demonstrate availability of suitable facilities for practical, general and theoretical instruction, appropriately equipped with teaching and learning aids and designed to enable each learner to fully engage in the learning process. All facilities must be maintained and where appropriate, inspected and tested in accordance with applicable regulations, current standards and manufacturers recommendations.

(137)

3.1 Engine Room Simulators

- The Engine Room Simulator shall be type approved by DG Shipping or an IACS Class society and demonstrate its capability of fulfilling the requirements of Appendix 2 of IMO Model Course 2.07 Engine Room Simulator (2017 Edition)
  Simulator Specifications: As per Annexure 2
  AND
- Desk Top Computer Based Diesel Engine Combustion Gas Monitor Simulator
  Simulator Specifications: As per Annexure 2

The Diesel Engine Combustion Gas Monitor Simulator may be integrated into the Engine Room Simulator.

3.2 Briefing / Debriefing room

Briefing / Debriefing room shall be of minimum area of 12 sq. and equipped with a white / black board, overhead / LCD projector / monitor, PC/ Laptop.

4.0 COURSE DETAILS

4.1. Course Duration: 3 days (18 hours)

4.2. Course Outline: As per given in Annexure 1

4.3. Course Certificate: As per format given in Annexure 3.

5.0 HOLIDAYS

5.1. Sundays shall be holidays.

5.2. Independence Day (15th August) and Republic Day (26th January) shall be compulsory holidays.

5.3. Students shall normally enjoy the holidays observed by the Govt. of the State in which the institute is located.

6.0 FACULTY REQUIREMENT

6.1 **Qualifications and experience of course in charge:**

Course In-charge shall :

- hold Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- have not less than 5 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course and MEO Class I simulator course

6.2 **Qualifications and experience of faculty members:**

The faculty shall :

- Hold a Certificate of competency MEO Class I (FG) issued or recognized by the Government of India, AND
- Have not less than 4 years of sea going service onboard merchant vessels above 3000 kW
- has completed Engine Room Simulator (Management level) course and MEO Class I simulator course

6.3 **Visiting faculty members:**
Qualifications and experience of visiting faculty members should be the same as that of regular faculty as specified above.

6.4 All faculty members shall hold Training of Trainers & Assessors Course Certificate.(TOTA / VICT) (as per DGS Circular 26 of 2018, VICT course)

6.5 **Age limit for regular faculty members:**
As per DG Shipping Training Manual (Issue 1 /October 2018).

7.0 FACULTY STRENGTH

7.1 Not less than two faculty, of which one is the course-in-charge. The Faculty: Trainee ratio shall be not more than 1:8 for theory sessions and 1:4 for simulation exercises.

7.2 Minimum of 50% of the entire portion must be covered by full time faculty. (As per DGS Order no. 5 of 2016).

8.0 COURSE DURATION
A total of 18 hours of lectures, including practical training and assessment.

9.0 ASSESSMENT
Assessment would be carried out at the end of each course.

10.0 QUALITY STANDARDS
As per DG Shipping Training Manual (Training Circular 31 of 2018)

11.0 INSPECTIONS
As per DG Shipping Training Manual (Training Circular 31 of 2018)

12.0 COST OF INSPECTIONS
As per DG Shipping Training Manual (Training Circular 31 of 2018) and Training Circular 29 of 2018.

13.0 FEES TO GOVT.
As per DG Shipping Training Manual (Training Circular 31 of 2018)

14.0 TEACHING AIDS

PUBLICATIONS:

IMO references (mandatory

R1. International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, (STCW) 1978 as amended.
R2. IMO model courses: 7.02 – Chief Engineer Officer and Second Engineer Officer

(135)

R3. IMO model course: 2.07 – Engine Room Simulator – 2017 edition

Textbooks (mandatory)

T1 : Instruction books on operation of the simulator

Bibliography (non-mandatory)

B1: Taylor, D.A. Introduction to Marine Engineering. 2nd ed. London, Butterworth. 1990 (ISBN 07-50-6253-9)

B2: Diesel Engines for Ship Propulsion and Power Plants, Volume I & II. K. Kuiken Target Global Energy (ISBN 978-90-79104-02-4)

B3: Pounder's Marine Diesel Engines and Gas Turbines, 8th edition (ISBN 0-7506-5846-0)

B4: McGeorge H.D., Marine Auxiliary Machinery, Seventh Edition, Butterworth-Heinemann, 1995 (ISBN 0 7506 4398 6)

B5: Application of Automatic Machinery and Alarm Equipment in Ships; R. G. SMITH; Institute of Marine Engineers; (ISBN: 0900976152)

B6: IMO Model Course 6.10 – Train the Simulator Trainer

15.0 Course Outline and Simulator Exercises - Annexure 1

16.0 Engine room simulator specifications - Annexure 2

17.0 Sample certificate to be issued on successful completion of course - Annexure 3

96

ANNEXURE – 1 COURSE OUTLINE

	Knowledge, Understanding and Proficiency (Learning Objectives)	Theory (Hours)	Simulation (Hours)
1.	**Familiarisation**	0.5	
1.1	Plant arrangements		0.25
1.2	Instrumentation		0.25
1.3	Alarm system		0.25
1.4	Controls		0.25
2.	**Propulsive characteristic of main diesel engine**	1	
2.1	Propulsive characteristics of diesel engines including speed, output and fuel consumption,		2
2.2	Heat cycle, thermal efficiency and heat balance of marine diesel engine		2
2.3	Operating limits of propulsion plant		2
2.4	Efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery		2
2.5	Heavy weather running conditions of the main diesel engine		2
3.	**Computer Based Diesel Engine Combustion Gas Monitor Simulation**	1	
3.1	To obtain best Specific Fuel Oil Consumption (SFOC) for a load of main diesel engine for a specific fuel oil		4
	ASSESSMENT	0.5	
	Sub-Total	**3.0**	**15.0**
	Total	**18 hrs**	

All times indicated above include briefing, debriefing and assessment.

SIMULATOR EXERCISES

Note: The values mentioned in the exercises are based on a particular type of engine. These values may vary depending on the type of engines being simulated. The instructor should accordingly set the values appropriate to the engine being simulated.

Sample exercise -1

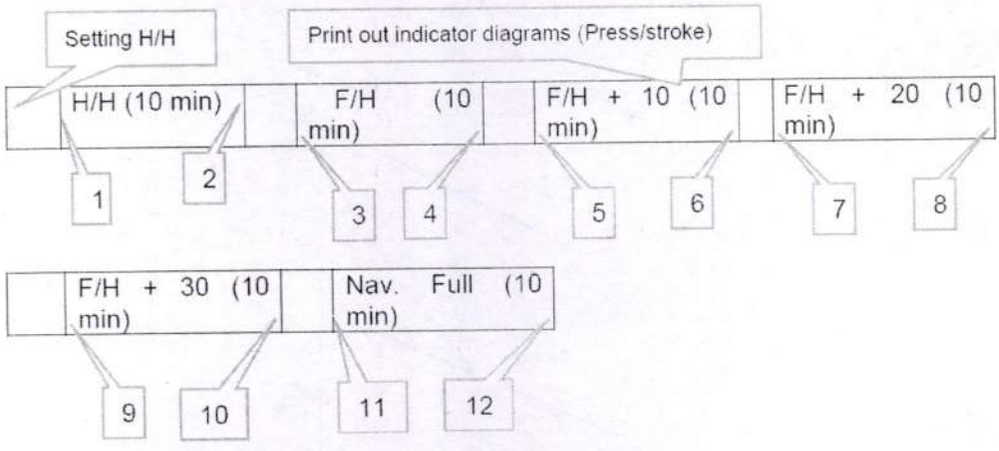
Exercise Title	Propulsive characteristics of diesel engines
Task	Development of engine revolution speed-output diagram
Function and Level	Marine engineering at the management level
Competence	Plan and schedule operations
Requirements (K.U.P.)	Propulsive characteristics of diesel engines including speed, output and fuel consumption
Outline of Training	Trainees establish a group and the group performs increase of the simulated main engines and develop a graph that indicate engine speed, engine output and fuel oil consumption by collecting necessary running parameters at different engine speeds. The trainees discuss the graph and understand propulsive characteristics of the main engines. The instructor needs to prepare engine speeds to collect the running parameters and measurement tables.
Initial Condition	Main engine standby condition
Specific Purpose	The training allows the trainees to: - understand correlation of engine output and fuel consumption to different engine speeds/ship's speeds , - come to be able to predict engine output and fuel consumption to different engine speeds/ship's speeds - understand differences in propulsive characteristics
Briefing	Explain briefly the following - outline of the training - how to carry on the training - specific purposes of the training - how to draw the graph obtaining necessary values
Implementation	Start the simulation and let the trainees: (The instructor may make simulation speed faster than usual in order to facilitate the training) - set main engine revolution speed and increase the speed as indicated in the table below - take readings following the measurement table at different speed under the stable conditions (The instructor stops the simulation when the measurement was completed)
Debriefing	The instructor lets the trainees discuss the diagram developed by the trainees and let them understand: - correlations of engine out and fuel consumption to different speeds are in principle: output $\propto N^3$ fuel consumption $\propto N^3$ ship's speed $\propto$ N fuel consumption of same distance $\propto N^2$ (N: Revolution speed) - differences in output/propeller curves of lighter or heavier engine loads than the specific engine load - differences in propulsive characteristics of different types of main engines

Measurement Table

Date:
Ship's Particulars:

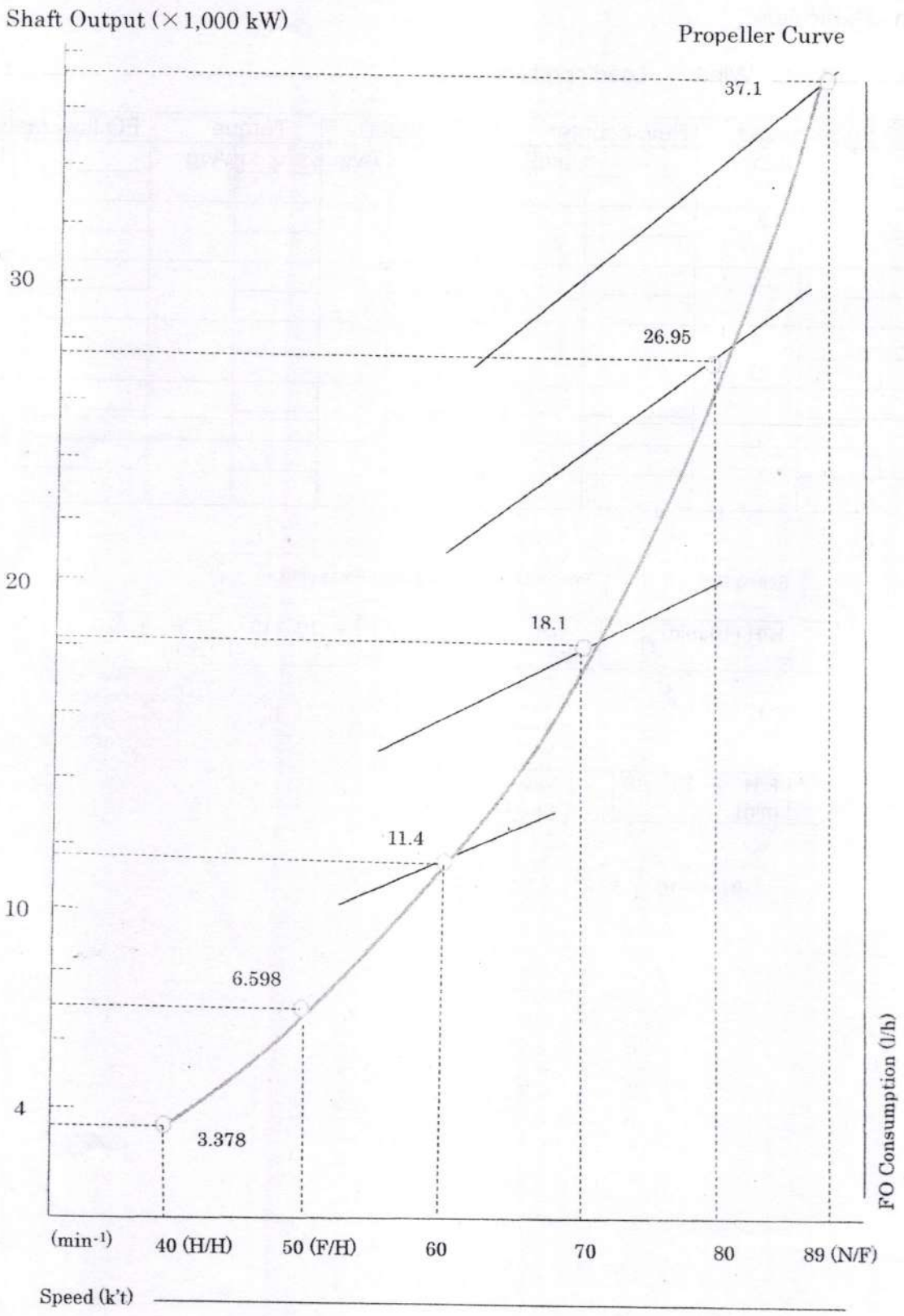
Sea condition: Wind: Load condition:

	Ship's speed		Rev. counter		Shaft output		Torque		FO flow meter	
1		Avg		min^{-1}		Avg		Avg		l/h
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										



131

Example of Shaft Output and Speed



90

Sample exercise - 2

Exercise Title	Heat balance of main diesel engine
Task	Determine thermal efficiency and develop heat balance diagram of the simulated main diesel engine
Function and Level	Marine engineering at the management level
Competence	Plan and schedule operations
Requirements (K.U.P.)	Heat cycle, thermal efficiency and heat balance of marine diesel engine
Outline of Training	Trainees establish two groups (A and B) and the groups collect running data following data collection tables at four stable running conditions of the simulated main engines as 100%, 75%, 50% and 25% MCR and calculate thermal efficiency for each load. All the trainees calculate necessary calorific values by using collected data and develop heat balance diagrams by combining all results made by the trainees. The instructor prepare data collection tables, calculation tables and guidance for the calculation. The instructor sometimes needs to give the trainee condition settings/assumptions in order to simplify the calculation although their theories must be taught. The instructor may make the simulation speed faster than usual to facilitate the training accordingly and conducts a review session on the issue on a different day, giving the trainees enough time for calculation and developing the diagrams. This training can be applied to different main engines
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - acquire knowledge on calculation methods/process of the following and developing heat balance diagram (Main diesel engine) - total calorific value given to engines/boilers - calorific values of power output produced by engines including calculation of output/IHP by using p-v diagram printed out from the simulator and "Ten divisions into equal method" given appropriate "Spring constant" of the indicators) - mechanical loss/efficiency by engines - fuel oil consumption rate - heat loss by cooling fluid and lubricating oil - heat loss by exhaust gas - thermal efficiency - understand; - how much heat was used for propelling - what kinds of heat losses are contained in the heat cycle - how much heat losses are included in the heat cycle
Briefing	Explain briefly the following - outline of the training - how to carry on the training

<table>
<tr><td></td><td>- specific purpose of the training
- precaution for collecting data
- data collection tables
- setting up revolution speed equivalent to engine loads</td></tr>
<tr><td>Implementation</td><td>The instructor starts the simulation and lets the trainees perform the following:
(The instructor sets up 100% MCR of the engine adjusting engine revolution speed and informs the trainees of that engine running condition will become stable in five minutes and your data collection must start 5 minutes later)

<table><tr><td></td><td>Performance</td></tr><tr><td rowspan="2">Group A</td><td>Data collection of 100% MCR</td></tr><tr><td>Reduction of engine speed to the revolution equivalent to 75% MCR</td></tr><tr><td rowspan="2">Group B</td><td>Data collection of 75% MCR</td></tr><tr><td>Reduction of engine speed to the revolution equivalent to 50% MCR</td></tr><tr><td rowspan="2">Group A</td><td>Data collection of 50% MCR</td></tr><tr><td>Reduction of engine speed to the revolution equivalent to 25% MCR</td></tr><tr><td>Group B</td><td>Data collection of 25% MCR</td></tr></table>
The group A takes readings of main engine revolution counter and fuel oil flow meter just at starting time of data collection.

After taking readings of the counters, members of the group A work on collecting data on the mimic panel and data display of the simulator following the data collection tables.
(The group B observes performance of the group A)

The group A takes reading of main engine revolution counter and fuel oil flow meter just at the time of 60 minutes later from the first reading.

After taking the second readings of the counters, the group A perform operation to reduce engine speed until the revolution speed equivalent to 75% MCR.

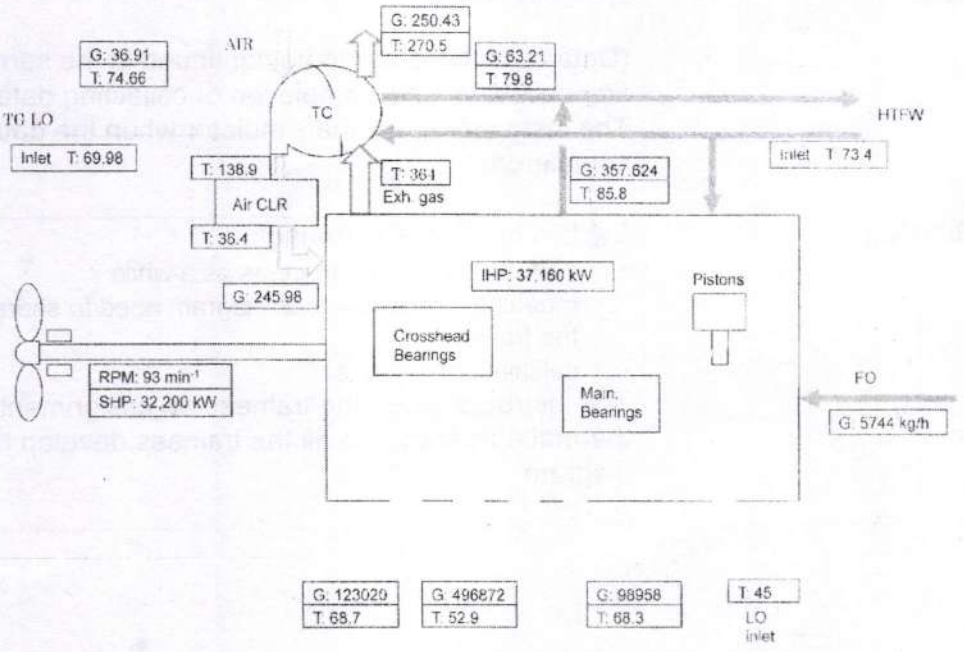
The group B prepares for data collection.
The group B takes readings of main engine revolution counter and fuel oil flow meter just at the time of starting data collection.

After taking readings of the counters, members of the group B work on collecting data on the mimic panel and data display of the simulator following the data collection tables.
(The group A observes performance of the group B)

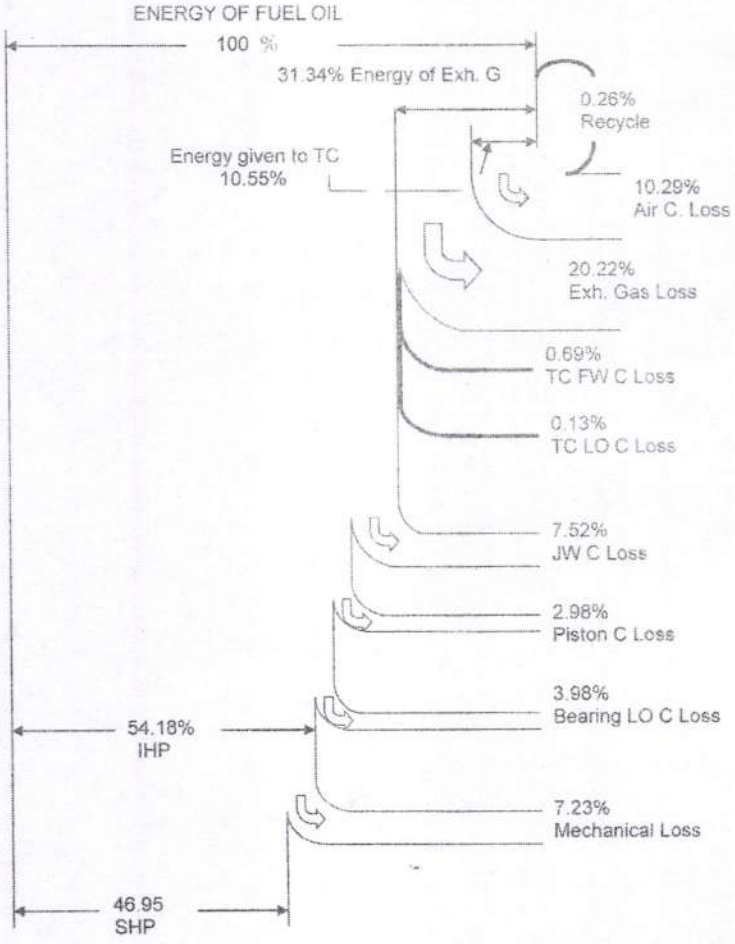
The group B takes reading of main engine revolution counter</td></tr>
</table>

	and fuel oil flow meter just at the time of 60 minutes later from the first reading. (Data collections are to be continued in the same manner as the first collection until completion of collecting data of 25% MCR. The instructor stops the simulator when the data collection is completed)
Debriefing	Explain briefly the following - performance of the trainees as a while - meaning of heat balance diagram need to share all data among the trainees - calculation methods The instructor gives the trainees an assignment to calculate the thermal efficiency and all the trainees develop heat balance diagram.

Example of ERS Heat Balance A (75% MCR)



Example of ERS Heat Balance B (75 %MCR)



Sample exercise - 3

Exercise Title	Operating limits
Task	Set up operating limits of the simulated main diesel engine
Function and Level	Marine engineering at the management level
Competence	Operation, surveillance, performance and maintaining safety of propulsion plant and auxiliary machinery
Requirements (K.U.P.)	Operating limits of propulsion plant
Outline of Training	Trainees establish a group and the group performs operations on the simulated main engine and sets up operating limits by collecting running parameters and comparing the data with running standards of the simulated main diesel engine
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to identify and understand: - running parameters concerned in operating limits - a need to keep the running parameters within specific operating limits - possible damages caused by running the engine in out of operating limits
Briefing	Explain briefly the following - how to conduct the training - measurement tables of running parameters - operating limits usually come from the relation between engine output or torque and speed - however some of running parameters can be factors as an operating limit other than engine output, torque and speed - operating limits concerned in the simulated main engines
Implementation	The instructor sets the hull and weather conditions as follow and starts the simulation: - Light condition + calm weather - Loaded condition + calm weather - Loaded condition + heavy weather The trainees increase the main engine speeds under these conditions as follow: - harbour full + 20 min^{-1} or revolution speed equivalent to 50% MCR - harbour full + 30 min^{-1} or revolution speed equivalent to 65% MCR - harbour hull + 40 min^{-1} or Revolution speed equivalent to 80% MCR - revolution speed equivalent to 100% MCR - revolution speed equivalent to 105% MCR The trainees move steering rudder within 10 ~ 15 degree after the engine speed reaches to the desired speeds and keep the rudder position until measurement of running parameters completes. (the measurement should be started approximately 10 minutes later after the rudder position was changed) - running parameters to be taken (example) - Log speed - engine/shaft output

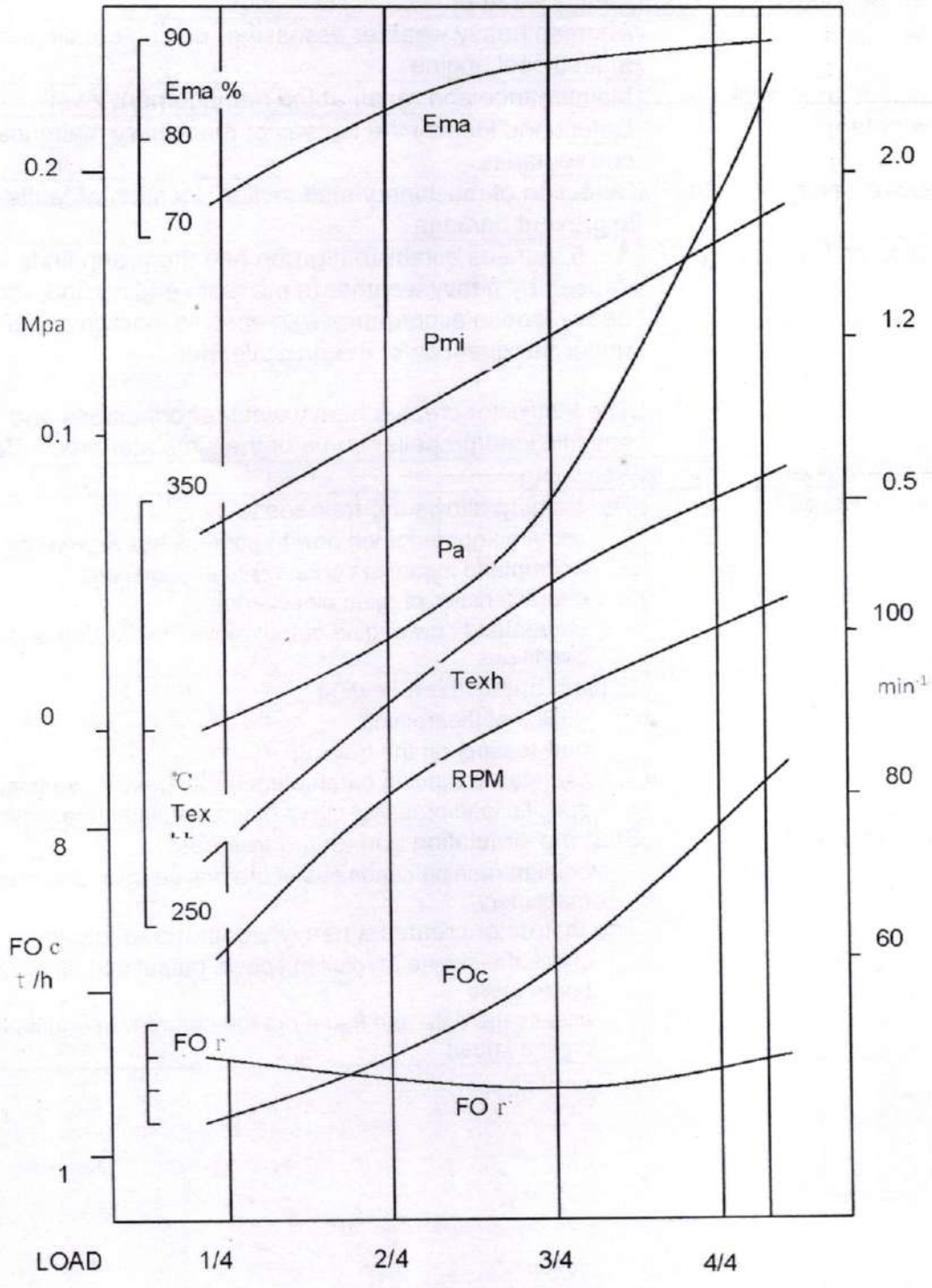
	- engine torque/mean effective pressure - cylinder maximum pressure - engine revolution speed - turbocharger revolution - scavenging air pressure - exhaust gas temperature - exhaust gas economizer gas inlet pressure - pressure drop by suction filter inside turbocharger - pressure drop by air cooler - cooling water temperature After collecting the running parameters, the trainees set the rudder position at mid-ship and increase the revolution speed and record the parameters. The instructor stops the simulation after all running parameters were taken and lets the trainees develop a revolution-output (load curve/propeller curve) and plot the specific load curve and torque lines and mark the recorded outputs on the graph. The trainees develop a table of other running parameters taken and compare the parameters with specific data of the simulated diesel engine.
Debriefing	Explain briefly the following and let the trainees discuss the operating limits of the simulated main diesel engine - An engine has operating limits from various aspects - Any running parameter must be kept within the operating limits in principle - engine manufacturers provide an operation limits of engines delivered

Sample exercise - 4

Exercise Title	Engine performance
Task	Assessment of main diesel engine and plant performances
Function and Level	Marine engineering at the management level
Competence	Operation, surveillance, performance and maintaining safety of propulsion plant and auxiliary machinery
Requirements (K.U.P.)	The efficient operation, surveillance, performance assessment and maintaining safety of propulsion plant and auxiliary machinery
Outline of Training	Trainees establish a group and the group performs operations of the simulated main engine collecting necessary running parameters and assess the engine and plant performances in terms of collected running parameters such as p-v diagrams, pressure-stroke diagrams, engine output, revolution speed, fuel consumption and others. Engine revolution speed: - harbour full (25% MCR) (two diesel generators are in service) - equivalent to 50% MCR (one diesel generator is in service) - equivalent to 75% MCR (one diesel generator and fresh water generator are in service) - equivalent to 100% MCR (turbo generator and fresh water are in service) The trainees also develop an engine performance curve by using collected data and calculate quantity of fuel necessary for 100 miles in accordance with plant conditions. The instructor prepares measurement tables and template of the performance curve in accordance with the specifications of simulated main engine and plant machinery.
Initial Condition	Main engine harbour full
Specific Purpose	The training allows the trainee to understand: - how p-v diagram is assessed - how pressure-stroke diagram is assessed - meaning of performance curve - the most efficient operation
Briefing	Explain briefly the following - how to conduct the training - measurement tables giving necessary information on the main engine - plant condition for measurements
Implementation	Start the simulation setting the main engine to engine speed equivalent to quarter load/harbour full and let the trainees: (Measurements of fuel oil consumption and main engine revolution speed should be accurately done by reading flow and revolution counters) - collect running parameters following the measurement tables including print out the p-v and p-stroke diagrams for the first plant condition

	- increase the engine speed and set up the plant condition as 50% MCR and one diesel generator is in service - carry out the measurements in the same manner as the first plant condition - increase the engine speed and set up the plant condition as 75% MCR and one diesel generator and fresh water generator are in service - carry out the measurements in the same manner as the first plant condition - increase the engine speed and set up the plant condition as 100% MCR and turbo generator and fresh water generator are is in service - carry out the measurements in the same manner as the first plant condition The instructor stops the simulation and lets the trainees determine the following and develop the engine performance curve by using the collected data and results of calculations. - average engine revolution speed in min^{-1} - fuel consumption of the main engine, the diesel generators and the boiler - fuel consumption rate of the main engine - fuel consumption rate of the diesel generator - fuel consumption for 100 miles - propeller slip The instructor lets the trainees discuss p-v diagram, pressure-stroke diagram from the aspect of combustion taken place in the cylinder and the performance curve in comparison with the specification of the simulated main diesel engine.
Debriefing	Explain briefly the following - summary of the training - how p-v and pressure-stroke diagrams are obtained in actual ships - how p-v and pressure-stroke diagrams should be utilized for managing the main engine - causes of detective pressure-stroke diagram - how the performance curve should be utilized for managing the main engine

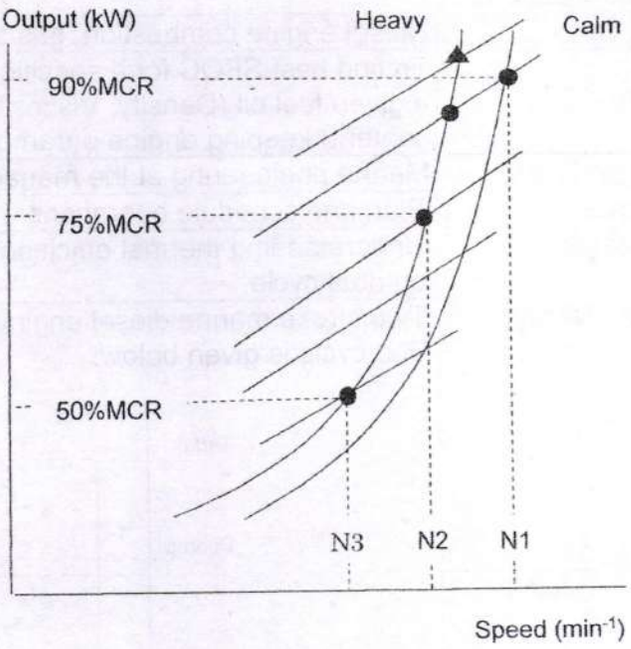
Example of ERS Main Engine Performance Curve



Ema : Mechanical Efficiency FOc : Fuel Oil Consumption
Pmi : Mean Indicated Pressure For : Fuel Oil Consumption Rate
Pa : Scavenging Air Pressure Texh : Exhaust Gas Temperature

Sample exercise - 5

Exercise Title	Heavy weather
Task	Address heavy weather assessing running conditions of the main diesel engine
Function and Level	Maintenance and repair at the management level
Competence	Detect and identify the causes of machinery malfunctions and correct faults
Requirements (K.U.P.)	Detection of machinery malfunction, location of faults and action to prevent damage
Outline of Training	4 ~ 5 trainees establish a group and the group finds heavy load caused by heavy weather to the main engine and addresses the heavy load in accordance with specific load/propeller curve under the direction of the group leader. The instructor creates heavy weather conditions and prepares specific load/propeller curve of the simulated main diesel engine
Initial Condition	Seagoing
Specific Purpose	The training allows the trainees to: - acquire knowledge on how to address heavy weather - understand meanings of heavy load conditions - characteristics of main diesel engine - understand how engine output moves under heavy load conditions
Briefing	Explain briefly the following - outline of the training - how to carry on the training - changes in running parameters under heavier weather - specific load/propeller curve of the simulated main diesel engine
Implementation	Start the simulation and let the trainees: - confirm running conditions of the main engine and auxiliary machinery The instructor creates a heavy weather and lets the trainees to: - check the engine revolution speed, output and other running parameters - assess the data and figure out the changes in engine load to the engine speed

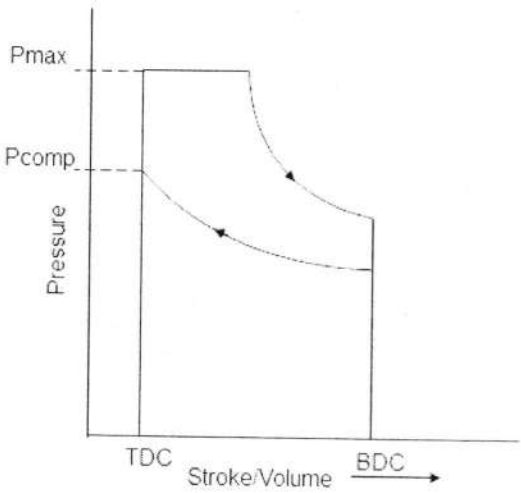
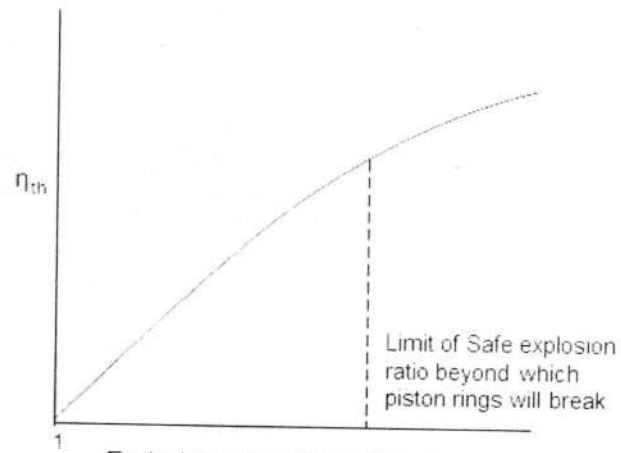


- decide reduction of the engine load to avoid over torque
- decrease the engine load to the predetermined speed
- check the running parameters of the engine
- check running condition of other systems such as power generation, FWG and steam generation systems
- assess the running conditions of the engine in terms of output, P_{mi} (mean effective pressure), P_{max} (Maximum pressure) and exhaust gas temperature for the new revolution speed, and impacts on power generation system
- decide further reduction of the engine load to avoid over torque
- changeover power generation system to No. 1 diesel generator from Turbo generator (TG), keeping TG in hot condition
- stop FWG keeping it in vacuum and start auxiliary boiler
- decrease the engine load to the predetermined speed
- check the running parameters of the engine
- check the indicator diagram and draw curve
- assess the running conditions of the engine in terms of output, P_{mi} (mean effective pressure), P_{max} (Maximum pressure) and exhaust gas temperature for the new revolution speed, and impacts on power generation system

The instructor stops the simulation after the engine output enter allowable engine output.

Debriefing	Explain briefly the following - how the engine output moves when hull condition becomes heavier due to some reasons - torque and over torque/torque rich - impacts on main engine under over torque/torque rich

Sample exercise - 6

Exercise Title	Diesel engine combustion gas simulation
Task	To find best SFOC for a specified load of the main diesel engine for a given fuel oil (Density, Viscosity, Sulphur content and water content) keeping engine parameters in safe limits
Function and Level	Marine engineering at the management level
Competence	Plan and schedule operations
Requirements (K.U.P.)	Understanding thermal efficiency Marine diesel engines operating on dual cycle.
Outline of Training	Two stroke marine diesel engines operate on Dual Cycle. The cycle is given below:  Dual Cycle The thermal efficiency curve is given below:  Explosion ratio = Pmax/Pcomp In order to obtain best SFOC and safe operation of the diesel engine, following parameters must not be exceeded: - maximum permissible P_{max} - maximum permissible explosion ratio (P_{max}/P_{comp}) - maximum permissible NOx emission For a specific load of main diesel engine and a given fuel, beginning

	of fuel injection is to **be adjusted (advanced/retarded)** so as not to exceed above parameters and obtain **best SFOC**.
Specific Purpose	The training allows the trainees to: - understand correlation of engine output and fuel consumption to different engine speeds/ship's speeds , - come to be able to predict engine output and fuel consumption to different engine speeds/ship's speeds - understand that fuel bunkered in different ports have different characteristics (Density, viscosity, sulphur content, water content and calorific value)
Briefing	Explain briefly the following - outline of the training - how to carry on the training - specific purposes of the training - give fuel specification to each trainee (Density, viscosity, sulphur content, water content) - obtain calorific value of above fuel by empirical formula given below Gross specific energy (MJ/kg) = $(52.19 - 8.802\rho^2 10^{-6}) \times [1 - 0.01(x + y + s)] + 9.42(0.01s)$ Net specific energy (MJ/kg) = $(46.704 - 8.802\rho^2 10^{-6} + 3.167\rho 10^{-3}) \times [1 - 0.01(x + y + s)] + 0.01(9.42s - 2.449x)$ where: ρ is the density at 15°C kg;/m^3; x is the water content, expressed as a percentage by mass; y is the ash content, expressed as a percentage by mass; s is the sulphur content, expressed as a percentage by mass. - specify % MCR on which the trainee has to run the diesel engine - specify maximum P_{max} of the diesel engine - specify maximum explosion ratio of the diesel engine - specify maximum NOx - how to feed the fuel characteristics in computer - how to change setting of beginning of injection of fuel oil (advance/retard) in the computer - continue above process to advancing/retarding till best SFOC is obtained with exceeding any safe parameters of diesel engine -
Implementation	Each trainee completes his exercise and submits his result to the instructor, who verifies same.
Debriefing	The instructor and trainees discuss their obtained results and compare them with results obtained by other trainees.

117

ANNEXURE 2 **Engine Room Simulator Specifications**

Engine room simulator specifications have been referenced from ERS II of Appendix 2 of IMO Model Course 2.07 and must meet requirements of relevant sections of A-I/12 and B-I/12 of STCW Code.

Engine room simulator should consist of the following partitioned spaces equipped with appropriate equipment based upon the learning/assessment points.

- Engine room
- Control room
- Instructor room
- Briefing / Debriefing room

Engine room comprises the following:

- Mimic panel
- Main engine local control stand
- Pump panels/Group starter panels (GSPs)
- Auxiliary boiler control stand
- Purifier control stand
- Sound system equipment
- Communication system equipment
- Illumination system equipment

Control room comprises the following:

- Main console
- Main switch board (MSB)
- Communication system equipment
- Sound system equipment
- Illumination system equipment

Instructor room comprises the following:

- Instructor console
- Simulator control equipment
- Communication system equipment

Classroom / Briefing room comprises the following:

- Instructor and Trainees Briefing table and seating
- Exercise Replay feed
- Overhead projector and screen / monitor

A. Outline of engine room installations
(Mimic panel)

- The latest and typical diesel engine propulsion plant is represented on the panel with its constructing machinery, piping diagrams and recommended accessories such as lamps, switches, meters and indicators.

104

- The panel must be designed based on the following ideas for effective training of plant operation and for better understanding of construction of the plant system:

(1) The panel should be such it would be possible for trainees to:
   - observe the entire range of the panel from the appropriate position of the engine room and easy to identify what machinery comprises the propulsion plant;
   - Identify mutual relationship of the machinery and actual arrangement of boiler, generator and other auxiliaries on board; and
   - stay in control of running conditions and status of the propulsion plant.

(2) The panel should be designed with the intent to allow trainees to easily learn piping and systems. Accessories should be of appropriate size in relationship to the learning objectives.

The following is considered to be precautions to meet the ideas above:

(1) Sufficient clear space would be desirable to present entire system of the diesel engine propulsion plant in terms of size of illustrated machinery, presentation of piping diagrams and the idea (1) aforementioned.

(2) Piping systems representing cooling fresh water, fuel oil, lubricating oil and others should be illustrated in recognizable color code, width, length and arrangement as much as possible.

(3) Actual relativity between the machinery should be reflected in designing their shapes and sizes.

(4) The illustrated machinery should be drawn and arranged in an impressive manner as much as possible according to actual arrangement on board.

(5) Appropriate size and number of indication meters for pressure, temperature, level and control parameters should be fitted on the panel as necessary to allow trainees to observe the running conditions.

(Main engine control stand)

Main engine control stand is a desk type control stand equipped with main engine manoeuvring equipment, engine telegraph and communication system equipment.

(Pump panel/Group Starter Panel: GSP)

Pump panel/GSP is a panel equipped with starter panels of auxiliaries such as pumps, air compressors and purifiers.

(Auxiliary boiler control stand)

Auxiliary boiler control panel is a desk type control stand equipped with manual and automatic control equipment and available to remotely control the auxiliary boiler represented on the mimic panel.

(Purifier control stand)

Purifier control stand is a desk type control stand equipped with manual and automatic control equipment of FO, DO and LO purifiers and available to remotely control the purifiers represented on the mimic panel

(115)

(Sound system equipment)
A speaker of the sound system plays simulated engine room sounds according to running conditions of the propulsion plant while simulation is performed.

(Communication system equipment)
The main engine control stand should be equipped with communication system equipment which are microphone to communicate to the control and instructor rooms with speaker systems, speaker to sound messages from the control and instructor rooms to all persons in the engine room.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the engine room.

B. Outline of Control room Installations
(Main console)
The main console is a desk front type console equipped with main engine remote and automatic control panel, monitoring (Data logger) system and main auxiliary machinery control panel and others

(Main Switch Board: MSB)
The main switch board is dead front type panel equipped with recommended panels.

(Communication system equipment)
Microphone and speaker systems

(Sound system equipment)
A speaker of the sound system plays simulated control room sounds caused by operation of the propulsion plant.

(Illumination system equipment)
The illumination system equipment consists of room and emergency lightings which are controlled by simulated conditions of the propulsion plant.

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructors can observe the actions made by trainees in the control room.

C. Outline of instructor room installations
(Instructor console)
The instructor console is a desk front type console equipped with simulator control equipment, communication system equipment, CCTV system equipment

106

(Simulator control equipment)
Simulator control equipment control various functions of the simulator consisting of the dedicated key board, monitor display and control unit

(Communication system equipment)
Microphone and speaker systems

(Visual observation of trainees)
The instructor should be able to view the trainees actions either through one way glass or through Cameras of CCTV system installed at suitable positions so that instructor can observe the actions made by trainees in the engine and control room.

D. Outline of briefing / debriefing room
(Exercise Replay)
Projection / monitor to display exercise replay parameters, data logger system.

(Seating)
Table and chairs to seat 1 Instructor and 8 trainees

Engine room simulation equipment should be capable of simulating a main and auxiliary machinery system and incorporate facilities to:

1. create a real-time environment for seagoing and harbour operations, with communication devices and simulation of appropriate main and auxiliary propulsion machinery equipment and control panels;
2. simulate relevant sub-systems that should include, but not be restricted to, boiler, steering gear, electrical power general and distribution systems, including emergency power supplies, and fuel, cooling water, refrigeration, bilge and ballast systems;
3. monitor and evaluate engine performance and remote sensing systems;
4. simulate machinery malfunctions;
5. allow for the variable external conditions to be changed so as to influence the simulated operations: weather, ship's draught, seawater and air temperatures;
6. allow for instructor-controlled external conditions to be changed: deck steam, accommodation steam, deck air, ice conditions, deck cranes, heavy power, bow thrust, ship load;
7. allow for instructor-controlled simulator dynamics to be changed: emergency run, process responses, ship responses; and
8. provide a facility to isolate certain processes, such as speed, electrical system, diesel oil system, lubricating oil system, heavy oil system, seawater system, steam system, exhaust boiler and turbo generator, for performing specific training tasks.

Desk Top Computer Based Diesel Engine Combustion Gas Monitor Simulator

Above computer to have a built in software programme based on a particular type of two stroke, slow speed, crosshead type of diesel engine. The built in software should permit running of the

diesel engine at different percentages of MCR and the following can be altered in the input to the computer:

1. Density, viscosity, % sulphur content and % water content of fuel oil
2. Can automatically calculate calorific value of fuel or accept calorific value calculated by empirical formula
3. Beginning of fuel injection can be altered (advance/retard)

It should be capable of displaying following for above changes made to each input

1. Display p-v diagram and draw card
2. Give digital values of P_{max} and P_{comp}
3. Power being developed
4. Consumption of fuel
5. NOx in exhaust gas in g/kWh

ANNEXURE 3 - Sample certificate to be issued on successful completion of course

Institute's Logo

NAME and ADDRESS of the D. G. Approved Training Institution

MTI No: **Tel:** **Fax:** **E-mail:**

Certificate No:_____

THIS IS TO CERTIFY THAT *[full name of candidate]*

Date of Birth ..... (dd/mm/yyyy)

Holder of C.D.C. No. .....

Certificate of Competency / Proficiency, (if any) Grade: ..... No.....

Indian National Database of Seafarers (INDoS No.) .....

has successfully completed a training course in

ENGINE ROOM SIMULATOR
(MANAGEMENT LEVEL – CHIEF ENGINEER OFFICER)

held from..... to .....

The course is approved by Directorate General of Shipping (Vide letter ..... dated .....) and meets the requirements laid down in Section A-I/12 and B-I/12.73 and Table A-III/1of the STCW Convention 1978 as amended.

The candidate has also met the additional criteria specified in the STCW Convention, applicable to the issue of the certificate.

This Certificate is issued under the authority of the Directorate General of Shipping, Ministry of Shipping, and Government of India.

_____
Signature of Candidate

_____
Name, Indos No. and Signature of Course In-charge

Date of Issue:_____

Date of Expiry: UNLIMITED

Official Seal

Colour Photograph (35mm x 35mm)

_____
Name and Signature of Dean / Principal

Note :

1. All enquiries regarding this certificate should be addressed to the issuing authority al the address given above.