



Faculty of Marine Engineering

Department of Marine Engineering



Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

ENGINEERING KNOWLEDGE – II (Motor)

Time Allowed- Three Hours

Answer Six questions

Marks for each part of the question are shown in the brackets

Date: 2023.06.13

Pass marks: 50%

1. a) Explain the checks to be carried on the bedplate during routine inspection. (5 marks)
 - b) Name the common defects could be located during the above inspection. (5 marks)
 - c) Explain the basic function of the thrust bearing fitted in main propulsion engine (2 marks)
 - d) Describe the procedure of crankcase inspection (4 marks)
2. With reference to a 2-stroke slow speed main propulsion engine air starting system State, with reasons,
- a) Three safety features incorporated in an air starting system. State with reason why an engine may fail to turnover on air. (10 marks)
 - b) Explain how the cause of an engine failing to turn over on air may be determined. (4 marks)
 - c) What are the interlocks fitted in the above system. (2 marks)
- 3.
- a). Describe, with the aid of sketches, how an auxiliary engine cylinder liner is calibrated. (6 marks)
 - b). State, with reason, the positions on the liner at which the calibration readings should be taken. (4 marks)
 - c). State how liner calibration readings should be recorded. (4 marks)
 - d) State cause of excessive cylinder liner and piston ring wear. (2 marks)

4.

With reference to an electronically controlled large slow speed engine.

- a. State 4 benefits of electronically controlled fuel injection (2 marks)
- b. Describe any cylinder lubrication system used in electronically controlled engine (4 marks)
- c. State the function of following controllers.
 - i. MPC (2marks)
 - ii. CCU (2 marks)
 - iii. EICU (2 marks)
 - iv. ACU (2 marks)
 - v. ECU (2 marks)

5.

- a) Draw a pipeline diagram of the fuel oil system of a vessel operating with fuel oil. (6 marks)
- b) In the above diagram mark the mark the approximate pressures and temperatures at each stage. (4 marks)
- c) What is the best viscosity range to be maintained at the fuel injector (2 marks)
- d) What is the purpose of fitting fuel coolers in modern engine rooms (4 marks)

6. a). State the essential conditions, which must be satisfied by the air supply for a pneumatic control system. (2 marks)
- b). State the possible consequences if the air supply is contaminated. (2 marks)
- c). Sketch & describe a pneumatic control system for controlling temperature of main engine lubricating oil outlet of the cooler. (12 marks)

7.

With reference to turbochargers explain:

- a) Why are air coolers fitted? (2 marks)
- b) Why excessive cooling of air should be avoided? (2 marks)
- c) How are turbine glands sealed? (2 marks)
- d) How are bearings lubricated? (2 marks)
- e) Explain the term surging, stating how it occurs, its effect on the turbocharger and how it can be avoided; (6 marks)
- f) State two main types of turbocharging used in engines? (2 marks)

8.

- a) Explain how to residue accumulation of sludge in the scavenge space of a large slow speed two stroke engine (2marks)
- b) What are the indications of a scavenge fire (2 marks)
- c) Briefly explain the procedure of extinguishing a scavenge fire. (8 marks)
- c) Explain the possible damage which could be caused by a scavenge fire. (4 marks)

9.

- a) With reference to obtaining an indicator card from a large slow speed diesel engine;
- i) Name four types of indicator cards (2 marks)
- ii) Describe your initial checks and preparations (2 Marks)
- iii) State, the additional information required (2 Marks)
- b) Briefly explain how to calculate indicated power (10 marks)



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Examination for Officer in Charge of an Engineering Watch on Ships of 750kW Propulsion Power or More

ENGINEERING KNOWLEDGE – I (GENERAL)

TIME ALLOWED - THREE HOURS

Attempt SIX questions only as follows:

FOUR questions from Section A

ONE question from Section B

ONE question from Section C

Marks for each part of the question are shown in the brackets.

Pass mark 50 % of total **AND** also need to obtain the minimum of 8 Marks in each Section B and C.

Answers with clear sketches/diagrams, neat handwriting and clear expression will get full marks.

Date: 2023.06.12

Pass marks: 50%

Section A

1.
 - a) What is the Ballast Water Management Convention. (4marks)
 - b) When did the BWM Convention enter into force (2 marks)
 - c) Which ships does the convention apply to (2 marks)
 - d) What do ships need to do, now the treaty is in force. (2 marks)
 - e) What are the ballast water management standards (6 marks)
2. a) Briefly explain the following heat treatment processes
 - i) Annealing (3 marks)
 - ii) Tempering (3 marks)
 - iii) Hardening (3 marks)
 - b) Name one engine component from each category, utilizes the above heat treatment processes during manufacturing of large slow speed engine parts. (3 marks)
 - c) State the advantages of heat treatment of engine components (4 marks)

C/12 III Ministry

3. With reference to engineering material, briefly explain the following conditions.

- | | |
|------------------|-----------|
| i) Fatigue | (4 marks) |
| ii) Creep | (4marks) |
| iii) Brittleness | (4marks) |
| iv) Brinelling | (4marks) |

4. With reference to shell and tube type coolers

- | | |
|--|-----------|
| a) Sketch a longitudinal section of a cooler | (6marks) |
| b) Explain how expansion is accommodated | (2marks) |
| c) State the locations of cavitation and erosion taking place. | (2marks) |
| d) State the safety precautions to be observed during routine cleaning of the cooler | (4 marks) |

5. With reference to centrifugal pumps:

- | | |
|---|-----------|
| a) state the operating principle of a centrifugal pump and why it is unnecessary to fit a priming device. | (4 marks) |
| b) state two impeller types and which types of application they would be best suited for. | (2 marks) |
| c) explain why cavitation occurs and how to possibly reduce by design. | (6 marks) |
| d) What is NPSH of pump | (4 marks) |

6.

- | | |
|---|-----------|
| a) Describe the safety precautions necessary when working with deck machinery. | (2 marks) |
| b) Describe the maintenance requirements for anchor windlass and winches. | (6 marks) |
| c) State two important properties required for the hydraulic oil used for deck machinery. | (2 marks) |
| d) Briefly describe the routine maintenance carried out for deck cranes | (6 marks) |

7.

With reference to a vapor compression refrigeration system.

- | | |
|---|-----------|
| a) Make a line diagram of a refrigeration circuit showing the relative positions of the main components and safety devices in the system. | (6 marks) |
| b) Briefly explain, how two cool rooms can be operated at different temperatures by using a single set of refrigeration machinery | (8 marks) |
| c) State two different methods being used to de-frost the evaporator. | (2 marks) |

Section B

8. Describe with aid of a diagram the operation of the following components of electrical equipment & explain the purpose of each.

- a. Under voltage protection. (3 Marks)
- b. Miniature circuit breaker. (3 Marks)
- c. Electronic overcurrent relay (5 Marks)
- d. Reverse power relay. (5Marks)

9. a) State TWO indications that single phasing has occurred in the circuitry of a large 3-phase induction motor (2 marks)

b) Explain how the effects of single phasing may differ in EACH of the following.

i) Star (4 marks)

ii) Delta (4 marks)

c) Explain why single phasing in delta configuration is more serious than in star configuration, describing a means to overcome this disadvantage (6 marks)

Section C

10.

State with reasons, the main purpose of EACH of the following.

i) bulbous bow (4 marks)

ii) flare (4 marks)

iii) sheer (4 marks)

iv) camber (4 marks)

11.

With reference to the prevention of hull corrosion briefly explain the following:

a) Cathodic protection by sacrificial anodes (4 marks)

b) Briefly explain protection provided by ICCP system (8 marks)

c) State the purpose of shaft earthing system (2 marks)

d) State the purpose of MGPS system



MINISTRY OF PORTS AND SHIPPING
MERCHANT SHIPPING SECRETARIAT-SRI LANKA



EXAMINATION FOR CERTIFICATE OF COMPETENCY
OFFICER IN CHARGE OF AN ENGINEERING WATCH 750 kW OR MORE
ENGINEERING KNOWLEDGE-II (MOTOR)

*C/25110
Ministry*

TIME ALLOWED-THREE HOURS

Attempt only SIX questions

Pass mark 50% of total marks

Answers with Clear sketchers/diagram, Neat hand writing and clear expression will get full marks.

1. With reference to marine diesel engines:
 - a) state the purpose of a camshaft; (2 Marks)
 - b) state TWO methods of driving a camshaft on a large marine diesel engine; (4 Marks)
 - c) state the speed of the camshaft relative to the crankshaft on:
 - (i) a four-stroke engine; (2 Marks)
 - (ii) a two-stroke engine. (2 Marks)
 - d) sketch a fuel cam for a unidirectional diesel engine indicating EACH of the following:
 - (i) point of injection; (2 Marks)
 - (ii) peak; (2 Marks)
 - (iii) slow return. (2 Marks)

2.
 - a) Describe the procedure for taking crankshaft deflection of an auxiliary engine explaining all precautions that must be used. (8 Marks)
 - b) Explain the action to be taken if some crankshaft deflection readings are outside acceptable limits recommended by engine manufacturer. (8 Marks)

3.
 - a) State various types of indicator diagrams that are used to assess engine performance (5 Marks)
 - b) Specify the additional data needed in conjunction with these diagrams (5 Marks)
 - c) Explain how some abnormalities in indicator diagrams can be traced to indicator malfunction (6 Marks)

- 4.
- a) Explain the procedure to be carried out an inspection of the scavenge space on a large two stroke diesel engine. **(12 Marks)**
 - b) State FOUR reasons for carrying out a scavenge space inspection. **(4 Marks)**
5. With reference to starting air line explosion of a large slow speed engine
- a) Explain how explosion may initiate **(6 Marks)**
 - b) What are the safety devices fitted to prevent such an explosion **(6 Marks)**
 - c) State preventive actions to be taken as an engineer. **(4 Marks)**
6. With reference to auxiliary boilers:
- a) explain how scale formations on the heating surfaces; **(8 Marks)**
 - b) State TWO reasons why scale is undesirable; **(4 Marks)**
 - c) state how scale build up is prevented from forming in steam boilers. **(4 Marks)**
7. With regard to the injection and combustion of fuel oil explain the significance of the following;
- a) Ignition delay **(4 Marks)**
 - b) Atomization **(4 Marks)**
 - c) Penetration **(4 Marks)**
 - d) Turbulence **(4 Marks)**
8. a) Explain the routine procedure to putting the engine room into the UMS mode. **(8 Marks)**
- b) List EIGHT main engine parameters which should be recorded manually in the event of UMS failure, with reasons. **(8 Marks)**
9. Describe the fuel oil changing over procedure prior entering into an Emission Control Area (ECA) **(16 Marks)**