

CERTIFICATE OF COMPETENCY EXAMINATION

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF
MARITIME AND COASTGUARD AGENCY
MANAGEMENT ENGINEER (UNLIMITED)

040-13 - ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 19 March 2024

0915-1215 hrs

Examination paper inserts:

Notes for the guidance of candidates:

Candidates should note that 96 marks are allocated to this paper. To pass candidates must achieve 48 marks.

Materials to be supplied by examination centres:

Candidate's examination workbook

ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

1. As Chief Engineer Officer write a report to the engineering superintendent regarding the failure of a high pressure fuel pump unit on an electronically controlled engine. The report must explain the nature of the failure, how the failure was detected and the immediate action taken. The report must also explain the actions taken to replace the pump and the steps taken to minimise the risk of future similar fuel pump failures. (16)

2. (a) Describe, with the aid of a sketch, a main engine fresh water cooling water system, incorporating HT and LT systems. (10)
- (b) Describe the charge air supply system for a turbocharged engine, explaining the purpose of each main part. (6)

3. (a) Describe, with the aid of a sketch, a cylinder arrangement for a dual fuel 2-stroke engine, explaining how the gaseous fuel is delivered to the cylinder and ignited. (12)
- (b) Explain the term *Methane Slip* in reference to a dual fuel engine, stating why it occurs and the effect on the atmosphere. (4)

4. With reference to turbocharger systems:
 - (a) describe how performance of the system is monitored and how the information gathered is used to assess performance; (8)
 - (b) describe the arrangements for maintaining the systems in good condition. (8)

5. (a) Sketch a main engine fuel system from the HFO and Low Sulphur service tanks to the main engine, showing all important valves. (6)
- (b) Using the sketch drawn in part (a), write instructions for the changeover of a main engine fuel system from HFO to Low Sulphur fuel, indicating the timescale for each operation. (10)

6. With reference to marine diesel engine Selective Catalytic Reduction (SCR):
- (a) explain, with the aid of a graph, the influence that fuel sulphur content has on the operation of an SCR unit; (4)
 - (b) explain how the operation of a turbocharger system can have a detrimental effect on the unit when burning fuels with higher sulphur content; (4)
 - (c) describe, with the aid of a sketch, a system which maintains good engine performance of the turbocharger system and good NO_x reduction when burning fuels with higher sulphur content, explaining how conflicting conditions are met. (8)
7. Write a procedure for the actions to be taken in the event of an engine oil mist detector alarm being activated, stating the reasons for EACH action. The procedure must cover the period from activation of the alarm to return of the engine to normal operation. (16)
8. (a) Describe, with the aid of a sketch, a lubrication system for a trunk-piston engine which has an automatic standby capability. (8)
- (b) Describe, with the aid of a sketch, a cylinder lubrication system for a cross-head engine, explaining why a separate cylinder LO system is fitted. (8)
9. With reference to boilers and steam generation systems:
- (a) explain the term *water hammer*, stating how it is caused and describing the possible consequences of it; (4)
 - (b) explain how *water hammer* can be avoided; (4)
 - (c) describe, with the aid of a sketch, how the boiler fuel system may be operated in port to comply with local emission control regulations. (8)