

**CERTIFICATES OF COMPETENCY IN THE MERCHANT NAVY –
MARINE ENGINEER OFFICER**

EXAMINATIONS ADMINISTERED BY THE
SCOTTISH QUALIFICATIONS AUTHORITY
ON BEHALF OF THE
MARITIME AND COASTGUARD AGENCY

STCW 95 SECOND ENGINEER REG. III/2 (UNLIMITED)

042-28 – ENGINEERING KNOWLEDGE - MOTOR

TUESDAY, 27 MARCH 2012

0915- 1215 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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Materials to be supplied by examination centres:

Candidate's examination workbook

ENGINEERING KNOWLEDGE – MOTOR

Attempt SIX questions only

All questions carry equal marks

Marks for each part question are shown in brackets

1. (a) Write a procedure for dismantling and preparation for inspection of a crosshead engine bottom end bearing. (10)
- (b) Describe THREE defects which could be detected during inspection of a bottom end bearing and crankpin, in EACH case stating the possible cause of the defect described. (6)

2. With reference to diesel engine cylinder lubrication:
 - (a) state, with reasons, FOUR desirable properties of a lubricant to be used for a crosshead engine burning residual fuel; (4)
 - (b) explain why the timing of lubricant injection is important; (4)
 - (c) describe, with the aid of a sketch, an electronically controlled cylinder lubrication system, explaining how the quantity and timing of cylinder oil injection are regulated. (8)

3. (a) Sketch a main engine fuel injector, labelling the main parts and indicating how it operates. (8)
- (b) Explain why it is necessary to cool main engine fuel injectors. (4)
- (c) Describe how the fuel injector sketched in Q3(a) is cooled. (4)

4. With reference to main engine piston rings:
 - (a) state with reasons the clearances required; (6)
 - (b) describe how the clearances stated in Q4(a) are measured; (5)
 - (c) explain why the values of piston ring clearances are limited. (5)

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5. (a) Sketch a generator engine fuel system showing the main valves and components. (6)
- (b) For the system sketched in Q5(a), explain the procedure for changing a single generator engine from heavy fuel oil operation to diesel oil operation whilst other engines remain operating on HFO, stating the precautions which must be observed. (6)
- (c) Explain the purpose of a *blackout pump* stating how it operates. (4)
6. (a) Explain, with the aid of sketches, how the use of multiple air inlet and exhaust valves improve efficiency and performance of a diesel engine. (6)
- (b) Explain why valve rotation is sometimes used for exhaust valves. (5)
- (c) Describe how the frictional connection between the valve and the cylinder head is removed in order to allow for valve rotation by the use of a *spinner*. (5)
7. (a) Write a procedure for replacing turbocharger bearings. (8)
- (b) Describe, with the aid of a sketch, a labyrinth seal system fitted to a turbocharger, stating why such a seal is required. (8)
8. (a) Sketch a compressed air system for main and service air supply incorporating two main air compressors and two starting air receivers, indicating the services supplied and the normal working pressures for these systems. (8)
- (b) Explain why control air systems require an air dryer. (2)
- (c) Describe a control air dryer, explaining how it operates. (6)
9. (a) Describe, with the aid of a sketch, a composite boiler fuel system explaining how the main flame is ignited. (8)
- (b) Explain how the combustion air and fuel supplies to the burner are regulated in the system described in Q9(a). (4)
- (c) Explain how the boiler may be operated in a port where there are strict emission control regulations. (4)