

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

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

**SECOND ENGINEER (UNLIMITED)**

**042-28 - ENGINEERING KNOWLEDGE - MOTOR**

**TUESDAY, 26 March 2013**

**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

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## ENGINEERING KNOWLEDGE - MOTOR

Attempt SIX questions only

Marks for each part question are shown in brackets

### Section A

1. (a) State, with reasons, risks which may be encountered during the replacement of a main fuel pump. (6)
- (b) Describe, with the aid of a sketch, the replacement of a main engine fuel pump. (10)
  
2. (a) Describe, with the aid of a sketch, the lubricating oil systems for a crosshead main engine, stating the purpose of the main components. The sketch must indicate the direction of oil flow in the pipes and main items must be labelled. (10)
- (b) State, with reasons, THREE properties of ONE of the lubricants required for the systems described in part (a). (6)
  
3. (a) Explain the steps to be taken to ensure that a vessel, which normally operates on HFO, is operating completely on low sulphur fuel prior to entering an environmentally sensitive area where sulphur emission controls apply. (10)
- (b) Explain the possible consequences of operating an engine on fuel with a very low sulphur content (below 1% sulphur) after running on normal HFO. (6)
  
4. (a) State the problems associated with four-stroke engine exhaust valves which are not associated with the air inlet valves. (2)
- (b) Describe the features of exhaust valve system design which are intended to overcome the problems stated in part (a). (6)
- (c) Explain how the use of multiple cylinder head valves improves engine operating efficiency. (8)
  
5. (a) Describe, with the aid of a sketch, the procedure for removing a piston from a cylinder of a medium speed, *Vee-type* engine; it may be assumed that the cylinder cover has already been removed. (8)
- (b) Describe how the piston rings are removed from a medium speed engine piston, stating how the piston ring grooves are checked and new piston rings are fitted. (8)

6. (a) Sketch a section through a turbocharger showing the bearings in place and indicating how bearing lubrication is achieved. (8)
- (b) Describe a procedure for the replacement of bearings for the turbocharger sketched in part (a), stating the checks which must be carried out before the turbocharger is returned to service. (8)
7. (a) Sketch a main engine cooling water system, showing the coolant flow in all parts of the system. (8)
- (b) Explain how the correct temperature is maintained in all parts of the system, for the main engine cooling system sketched in part (a). (4)
- (c) Explain how the correct cooling temperatures may be maintained in the system sketched in part (a), in the event of the remote monitoring and control system failing. (4)
8. With reference to a main engine starting air system, explain EACH of the following:
- (a) why automatic drain traps are fitted at air compressor coolers; (4)
- (b) why it is necessary to remove oil and water from the air leaving the starting air compressor; (4)
- (c) what facilities are required to enable starting air compressors to be started and stopped automatically; (4)
- (d) why drains are required on starting air receivers and in other parts of the starting air system even though drains are fitted at starting air compressors. (4)
9. With reference to waste heat recovery systems:
- (a) explain why a steam dump facility may be required; (4)
- (b) describe how a steam dump operates during running of the main engine system; (4)
- (c) write instructions for in-service cleaning of the gas side of a waste heat steam generation system. (8)