

**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, 15 October 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

1. With reference to charge air turbocharged systems:
  - (a) state what instruments should be fitted in order to assess its performance; (4)
  - (b) explain how the information gathered from the instruments stated in part (a) is used to determine the performance in EACH of the following:
    - (i) the turbocharger gas side; (4)
    - (ii) the turbocharger air side; (4)
    - (iii) the charge air cooling system. (4)
  
2. (a) State the effect on the cylinder combustion and describe the possible consequences for engine components in EACH of the following conditions:
  - (i) early fuel injection; (5)
  - (ii) late fuel injection. (5)
- (b) State ONE means of changing fuel injection timing during engine operation, describing how the change in timing is brought about. (6)
  
3. (a) Explain why tie rods are fitted to crosshead engines. (6)
- (b) Describe a procedure for checking tie rod tension, indicating when the checking of tie rod tension should be carried out other than at routine times. (6)
- (c) Explain the possible consequences of uneven tie rod stresses. (4)
  
4. With reference to diesel engine driven emergency generators:
  - (a) describe the requirements for EACH of the following:
    - (i) starting systems; (3)
    - (ii) cooling systems; (3)
    - (iii) fuel systems. (3)
  - (b) Describe the procedure for manual test running of an emergency generator off load. (7)

5. (a) State which instruments are fitted at a local engine side control stand, in EACH case explaining why the device is required at that location. (4)
- (b) Describe how a main engine is changed over from remote control to local engine side control which allows manual operation of the fuel linkage. (4)
- (c) Describe the procedure for manoeuvring a main engine from the local engine side position when the governor is inoperative. (4)
- (d) Describe the precautions which must be observed when manoeuvring the main engine from the local engine side position. (4)
6. (a) Explain why high and low temperature cooling water systems are used for cooling main and generator diesel engines, stating which systems are cooled by the high and low temperature circuits. (6)
- (b) Sketch the fresh water cooling systems for a main diesel engine, naming the main parts and describing how the temperature is controlled automatically. (10)
7. (a) State, with reasons, the safety procedures to be observed when overhauling a piston rod diaphragm gland. (6)
- (b) Describe the procedure for overhauling a piston rod diaphragm gland, stating what checks must be made to ensure that the gland functions correctly when the engine is returned to service. (10)
8. (a) Explain why four-stroke engine exhaust valves generally require more frequent attention than air inlet valves. (4)
- (b) Explain exhaust valve design features which assist in prolonging the period between valve overhauls. (6)
- (c) Explain how the use of multiple air inlet and exhaust valves improves cylinder performance. (6)
9. With reference to exhaust gas economisers/waste heat boilers:
- (a) explain the possible consequences of not maintaining the gas side heat transfer surfaces in a clean condition; (5)
- (b) describe how the gas side heat transfer surfaces are maintained in a clean condition during operation of the unit; (6)
- (c) describe a gas side out-of-service cleaning method, explaining why out-of-service cleaning is necessary even though in-service cleaning is carried out. (5)