

**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)**

**042-27 - ENGINEERING KNOWLEDGE - GENERAL**

**MONDAY, 25 March 2013**

**0915-1215 hrs**

Examination paper inserts:

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Notes for the guidance of candidates:

Candidates are required to obtain 50% of the total marks allocated to this paper to gain a pass <b>AND</b> also obtain a minimum 40% in Sections A, B and C of the paper.
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Materials to be supplied by examination centres:

Candidate's examination workbook
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## ENGINEERING KNOWLEDGE - GENERAL

Attempt TEN questions only as follows:

SIX questions from section A

TWO questions from section B

TWO questions from section C

Marks for each part question are shown in brackets

### Section A

1. State a typical shipboard machinery application for EACH of the following metals, explaining how their properties make them particularly suitable for the stated application:
  - (a) stainless steel; (2)
  - (b) grey cast iron; (2)
  - (c) manganese bronze; (2)
  - (d) aluminium; (2)
  - (e) titanium. (2)
  
2.
  - (a) Sketch an engine room fresh water central cooling system, indicating the water temperatures at salient points on the system. (6)
  - (b) State FOUR advantages of the system sketched in part (a) compared to one which is totally sea water cooled. (4)
  
3.
  - (a) Sketch a tunnel type transverse bow thruster driven by a constant speed electric motor. (6)
  - (b) Describe the thruster sketched in part (a), stating how the direction and strength of thrust are varied. (4)
  
4.
  - (a) Sketch a hydraulically tensioned shaft coupling bolt which incorporates a tapered sleeve fitted between the bolt and the coupling holes. (4)
  - (b) Describe how the bolt assembly sketched in part (a) is fitted. (3)
  - (c) State the advantages of this type of arrangement compared to conventional bolt assemblies. (3)

5. (a) State the possible causes for EACH of the following auxiliary engine lubricating oil sample results:
- (i) high acidity; (2)
  - (ii) high sediment content; (2)
  - (iii) water content; (2)
  - (iv) fuel dilution. (2)
- (b) Explain which of the results in part (a) would give greatest concern. (2)
6. (a) Sketch a fully automatic provisions refrigeration system incorporating a number of cold spaces. (5)
- (b) Explain the sequence of events from a demand for refrigerating effect until all cold rooms have fully cooled down. (5)
7. With reference to the protection of mild steel main sea water cooling pipelines:
- (a) sketch an arrangement where impressed current anodes are fitted in the main sea chests to prevent corrosion and fouling; (4)
  - (b) describe how the system sketched in part (a) gives protection to steel pipework, stating the materials used; (4)
  - (c) explain why welding or hot work should not be carried out on sea water main lines. (2)
8. (a) Sketch a typical ship's firemain system. (5)
- (b) Describe the routine maintenance carried out on the system sketched in part (a) to ensure that it is at readiness for emergency situations. (5)

## Section B

9. (a) Sketch a standby emergency battery circuit which is charged by a. c. supply. (5)
- (b) List the safety precautions to be observed during the routine maintenance of acid or alkaline batteries. (5)
10. (a) Sketch a direct on line starter suitable for a three phase induction motor. (8)
- (b) Explain why the starter sketched in part (a) is limited to moderately sized motors. (2)
11. With reference to the protection of electrical power circuits:
- (a) explain *preferential tripping*, describing how it is achieved; (5)
- (b) explain *discrimination*, describing how it is achieved. (5)

## Section C

12. (a) State why ships' accommodation spaces require to be ventilated even when they are air conditioned. (3)
- (b) Sketch a mushroom ventilator as fitted on an accommodation structure. (5)
- (c) Describe the routine maintenance carried out on the ventilator sketched in part (b). (2)
13. With reference to the construction of refrigerated spaces: (2)
- (a) state suitable materials used for insulating the spaces; (2)
- (b) state the properties that an insulating material should possess; (3)
- (c) sketch a section through a wall of a cold storage space detailing how the insulation is attached to the ship's structure. (5)
14. As Second Engineer Officer, explain to a new crew member how to pass safely through a hydraulically operated watertight door. (10)