

**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**

**DRAFT PAPER, Paper 73-15 Oct 2012**

**- 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. (a) Describe, with the aid of a sketch, an oil content monitor suitable for sensing 15 ppm of oil in an oily water separator discharge. (5)
- (b) State THREE operations that are required to be logged in the oil record book. (3)
- (c) State an example of ONE of the entries stated in part (b). (2)
  
2. (a) Sketch a block diagram for a closed loop control circuit. (3)
- (b) Describe how the system sketched in part (a) operates. (4)
- (c) Explain why a system would include the controller integral and derivative action. (3)
  
3. With reference to a vapour compressor refrigeration system:
  - (a) describe, with the aid of a sketch, the operation of a high pressure cut out device; (6)
  - (b) state FOUR possible faults that could cause the cut out to operate. (4)
  
4. (a) Sketch and label all the major parts of a nine litre portable extinguisher for class A fires. (5)
- (b) List the maintenance tasks required for the extinguisher sketched in part (a). (3)
- (c) State the minimum range and discharge time. (2)

5. (a) Sketch a four ram electro hydraulic steering gear system. (5)
- (b) State why EACH of the following is fitted to a four ram steering gear:
- (i) brake or locking device; (1)
  - (ii) stock or tiller relief valve; (1)
  - (iii) steering gear stops or rudder stop. (1)
- (c) State the requirements of the legislation to the main and auxiliary steering gear with reference to rudder angle and time of operation. (2)
6. Describe EACH of the following processes for medium carbon steel and its effects:
- (a) Hardening; (3)
  - (b) Tempering; (3)
  - (c) Annealing; (2)
  - (d) Normalising. (2)
7. With reference to gland sealing on centrifugal pumps for fresh water duties:
- (a) compare the advantages and disadvantages of mechanical seal to soft packing; (4)
  - (b) sketch a cross section of a mechanical seal, labelling all main components. (6)
8. (a) List the essential items of a fireman's outfit. (4)
- (b) Describe the checks that should be carried out prior to firefighters entering a smoke filled atmosphere. (6)

## Section B

9. With reference to insulation testing of electrical equipment:
- (a) state the reason for insulating testing and why it is carried out on a regular basis; (2)
  - (b) describe the procedure for taking a set of insulation readings on an electric motor in-situ, stating the minimum acceptable readings; (6)
  - (c) state the additional precautions to be taken when testing an a.c. generator. (2)
10. Describe, with the aid of a circuit diagram, the operation of a direct on line starter. (10)
11. (a) Sketch a circuit diagram showing how power failure is detected, the emergency generator started and connected to emergency switchboard. (7)
- (b) State the minimum time by which the emergency generator must be capable of supplying full emergency load. (3)

## Section C

12. As Second Engineer Officer, explain to a new crew member how to pass safely through a hydraulically operated watertight door. (10)
13. (a) Explain the effects of pounding and panting at the fore end of a ship. (4)  
(b) Sketch the constructional details designed to resist panting and pounding. (6)
14. With reference to water drainage from the deck areas:
- (a) explain EACH of the following:
- (i) why scuppers are fitted in close proximity to the super structure whereas freeing port are generally fitted to open areas of the weather deck; (3)
- (ii) why it is essential that scuppers and freeing port are operational at all times; (4)
- (b) state which certificate relates to part (a) (i) and (ii). (3)