CERTIFICATES OF COMPETENCY FOR ENGINEERS (YACHT)

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

SMALL VESSEL CHIEF ENGINEER UNLIMITED

058-01 - APPLIED MARINE ENGINEERING

FRIDAY, 14 June 2019

1400-1600 hrs

Examination paper inserts:

Notes for the guidance of candidates:

1. Candidates should note that 100 marks are allocated to this paper. To pass candidates must achieve 50 marks.
2. Non-programmable calculators may be used
3. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer.

Materials to be supplied by examination centres:

Candidate's examination workbook

APPLIED MARINE ENGINEERING

Attempt ALL questions
Marks for each part question are shown in brackets

1. With reference to austenitic stainless steels:

   (a) list the THREE main constituents with approximate percentage composition; (3)

   (b) state the main difference between grades 304 & 316 and how this is achieved; (3)

   (c) list TWO typical applications for EACH grade stated in part (b) that would be found on a modern vessel. (4)

2. With reference to case hardening steel components:

   (a) describe the changes that occur with this process; (3)

   (b) explain why it may be required; (2)

   (c) describe EACH of the following processes:

      (i) a simple shipboard process; (3)

      (ii) solid pack carburising. (2)

3. Explain EACH of the following engineering terms:

   (a) hardness; (2)

   (b) proof stress; (2)

   (c) ultimate tensile strength (UTS); (2)

   (d) Young's Modulus; (2)

   (e) yield stress. (2)

4. With reference to the attachment of aluminium superstructures to a steel hull:

   (a) explain why it is not normal practice to join the two components using conventional welding techniques; (2)

   (b) state the particular problems associated with the aluminium superstructure where it is bonded to a steel hull; (2)

   (c) outline the maintenance that should be carried out to ensure the continued structural integrity of the vessel; (2)

   (d) sketch a typical transition joint that could be utilised to attach an aluminium superstructure to a steel hull. (4)

5. Explain EACH of the following terms:

   (a) galvanic corrosion; (2)

   (b) cavitation damage; (2)

   (c) erosion damage; (2)

   (d) stress corrosion; (2)

   (e) atmospheric corrosion. (2)

6. With reference to in service defects found in glass reinforced plastic (GRP) hulls:

   (a) state THREE possible causes of de-lamination; (3)

   (b) describe TWO methods of detecting de-lamination in service; (2)

   (c) describe TWO methods of repair to de-lamination on a sandwich construction hull; (2)

   (d) list THREE design problems that can lead to stress cracking. (3)

7. With reference to strain gauges:

   (a) describe, with the aid of a sketch, the principle and operation of a simple strain gauge, stating the formula used to determine its change in properties; (5)

   (b) explain how the device is connected into an electrical circuit to accurately measure pressure; (3)

   (c) state TWO practical applications in a vessel. (2)

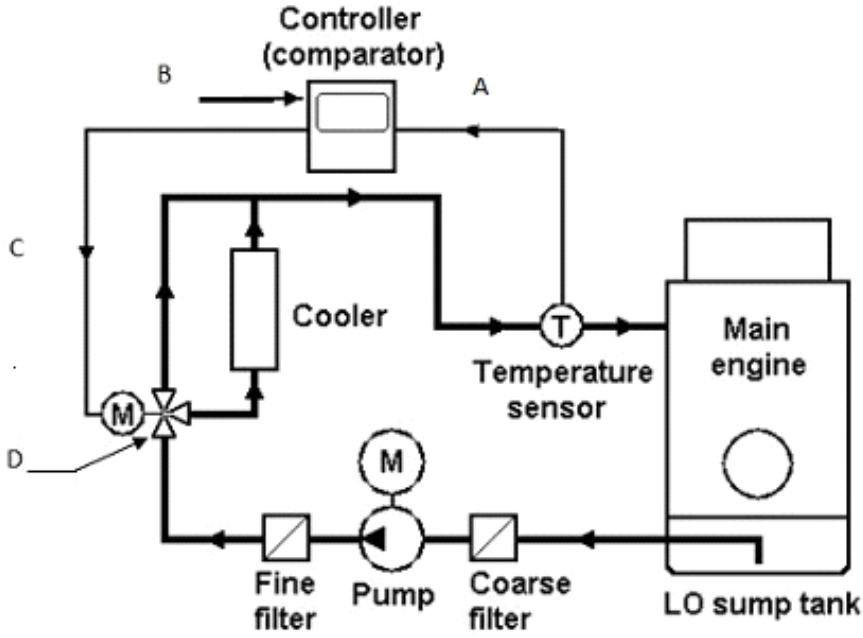
8. For the automatic closed loop engine cooling control system shown in the figure:

(a) identify the signal paths A, B, and C; (3)

(b) describe the function of the comparator; (2)

(c) name and describe the function of component D; (4)

(d) state a suitable device capable of producing a varying signal at T. (1)



Main engine LO temperature control system

Fig Q8

9. State a type of transducer or measuring device suitable for measuring EACH of the following parameters:

(a) accurate remote reading of a diesel engine exhaust temperature; (1)

(b) accurate remote reading of the twist of a propeller shaft; (1)

(c) accurate and remote position of a diesel engine governor or fuel rack; (1)

(d) the speed of a ship's main propeller shaft in RPM; (1)

(e) remote reading of a ship's intermediate shaft bearing temperature; (1)

(f) remote reading of lubricating oil pressure in a diesel engine; (1)

(g) flow rate of a water maker; (1)

(h) simple local pressure reading of ships fire-main; (1)

(i) the position of the steering gear or rudder; (1)

(j) local reading of jacket cooling water temperature. (1)

10. On passage at full sea speed, a high jacket water temperature alarm goes off. The header tank is full, there are no leaks in the systems, both the HT and SW pumps are running and in good condition, however the temperature is continuing to rise.

(a) State the immediate course of action that should be taken, explaining why. (2)

(b) From the information on the supplied system diagram, shown in the figure below, describe THREE possible actions that may bring the plant back to within normal operating parameters. (8)

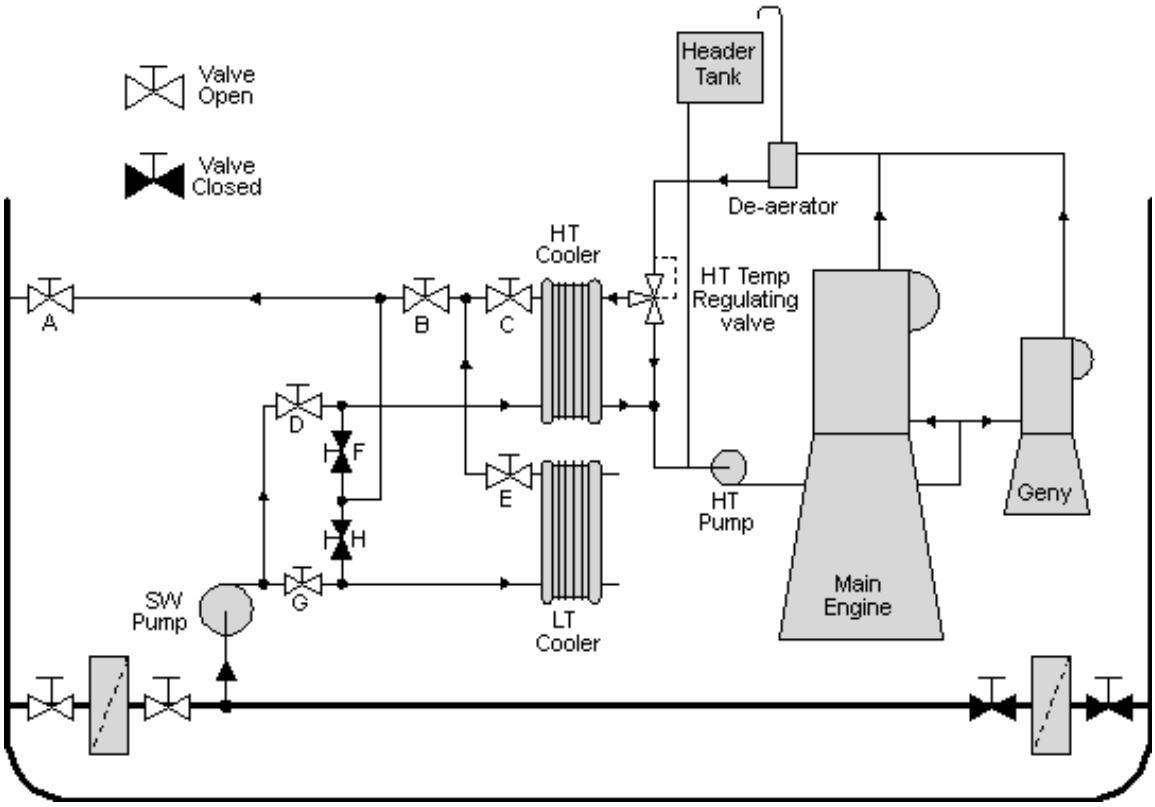


Fig Q10