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, 22 June 2018

1400-1600 hrs

Examination paper inserts:

Notes for the guidance of candidates:

1. Non-programmable calculators may be used.
2. 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. State, with reasons, a different material suitable for EACH of the following applications:

   (a) a large motor vessel propeller; (2)

   (b) a centrifugal pump impeller; (2)

   (c) a sea water cooled heat exchanger tube; (2)

   (d) a 300mm diameter sea water cooling pipe; (2)

   (e) a cylinder head of a small auxiliary engine. (2)

2. 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)

3. With reference to aluminium:

   (a) explain what is meant by *work hardening*; (2)

   (b) describe the internal changes when it becomes work hardened; (2)

   (c) state the effect work hardening has on its properties; (2)

   (d) describe how it could be annealed on board a vessel. (4)

4. (a) Describe TWO destructive tests that a sample of metal intended for the manufacture of a propeller shaft, would undergo before being accepted by a classification society. (6)

   (b) Explain the term safety coefficient (*factor of safety)*, stating why it is required. (3)

   (c) State a typical safety coefficient designed into a propeller shaft. (1)

5. With reference to the installation of copper pipes in engine cooling systems:

   (a) describe THREE possible causes for their premature failure; (6)

   (b) outline FOUR recommendations for the installation of copper pipes. (4)

6. With reference to joining a steel hull to an aluminium superstructure:

   (a) explain, with the aid of a sketch, the process of *explosion welding*; (6)

   (b) explain why this joint is superior to an insulated bolt joint. (4)

7. Explain how corrosion and its effects can be minimised in seawater cooling systems. (10)

8. With reference to a thermistor:

   (a) state the materials used in their construction, the principle of operation and the reason for their use on vessels; (4)

   (b) state the temperature range over which they are able to operate; (1)

   (c) state, with reasons, FIVE applications where thermistors may be found on board a vessel. (5)

9. (a) State the reasons for fitting a pneumatic process valve with EACH of the following:

(i) a volume booster; (2)

(ii) a feedback positioner. (2)

(b) State, with reasons, the type of actuator fitted to the process valves for EACH of the following systems:

(i) a fuel supply system in which the valve must not move on loss of power to the control system; (3)

(ii) a lubrication oil cooling system in which the valve diverts the oil through a cooler. (3)

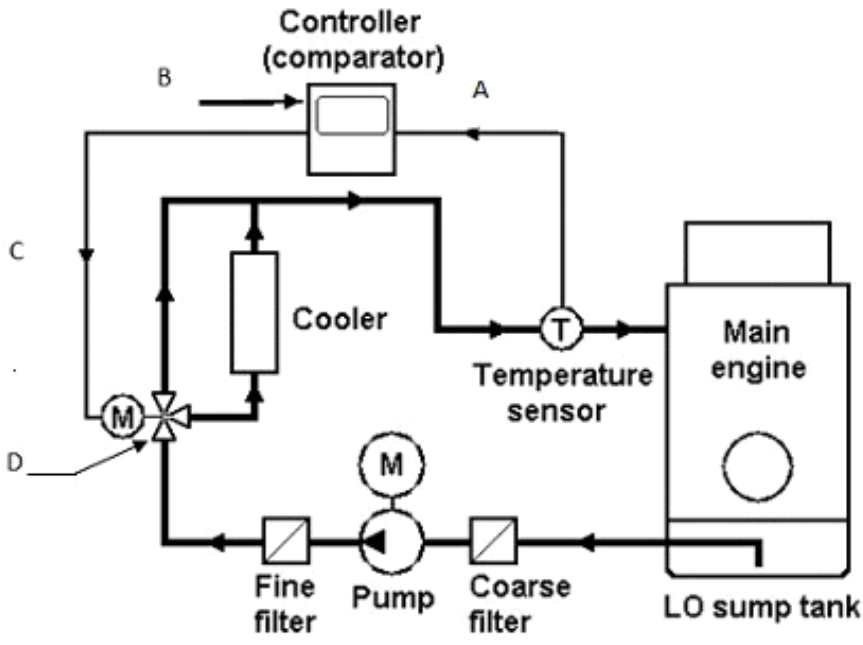
10. For the automatic closed loop engine cooling control system shown in the figure:

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

(b) describe the function of the comparitor; (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 Q10