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, 20 November 2020

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. (a) Explain how the properties of steel are modified by its carbon content. (2)

   (b) Explain EACH of the following terms:

   (i) annealing; (3)

   (ii) normalising; (3)

   (iii) hardening. (2)

3. (a) Explain EACH of the following terms:

   (i) plasticity; (2)

   (ii) sheer stress; (2)

   (iii) Young's modulus; (2)

   (iv) safety coefficient (factor of safety). (2)

   (b) State TWO factors that may influence the safety coefficient in operation. (2)

4. State, with reasons, a different welding/brazing/soldering process that is best suited to effect EACH of the following situations:

   (a) joining two lengths of aluminium bronze seawater pipe, both pipes having the same diameter; (2)

   (b) attaching a stainless steel handrail to a steel hull; (2)

   (c) re-attach a section of broken flange on a cast iron pump casing; (2)

   (d) attaching a brass flange onto a stainless steel pipe; (2)

   (e) attaching a 1.0 mm steel section to 10 mm thick deckhead plate. (2)

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

6. With reference to hot docking:

   (a) explain how this occurs, stating its effects; (6)

   (b) describe the operation of TWO devices that will prevent this occuring. (4)

7. With reference to capacitance probe sensors:

   (a) describe, with the aid of a sketch, how a capacitance probe produces an output which can be used to measure the liquid level in a tank. (7)

   (b) state TWO different uses of this device on a vessel; (2)

   (c) state ONE disadvantage of this type of probe. (1)

8. Describe, with the aid of a sketch, how a floatation device can produce an output signal that can be used to control the liquid level in a tank. (10)

9. (a) Define the term *Proportional Action.* (2)

   (b) Explain the purpose of *Integral Action*. (2)

   (c) Describe a possible effect of excessive Integral Action. (2)

   (d) Explain the purpose of *Derivitive Action*. (2)

   (e) Describe the effect of excessive Derivitive Action. (2)

10. Explain EACH of the following control terms:

   (a) settling time; (2)

   (b) repeatability; (2)

   (c) dead zone; (2)

   (d) hysteresis; (2)

   (e) proportional bandwidth. (2)