

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 November 2019

1400-1600 hrs

Examination paper inserts:

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Notes for the guidance of candidates:

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| <ol style="list-style-type: none">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 used3. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer. |
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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. (a) Outline THREE disadvantages of using aluminium in vessel construction. (3)
- (b) Outline THREE advantages of using steel in vessel construction. (3)
- (c) Outline FOUR conditions necessary in the preparation of steel surfaces prior to painting, to ensure a good surface finish. (4)

2. 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)

3. Describe, with the aid of load extension graphs, EACH of the following engineering terms:
 - (a) limit of proportionality; (2)
 - (b) yield point; (2)
 - (c) Ultimate Tensile Strength; (2)
 - (d) 0.1% Proof Stress. (4)

4. With reference to gas metal arc welding (MIG) of mild steel:
 - (a) describe the process; (3)
 - (b) explain, with reasons, the surface preparation required; (3)
 - (c) list THREE advantages and ONE limitation. (4)

5. 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 occurring. (4)

6. With reference to marine corrosion:
- (a) list EIGHT factors that influence the rate of corrosion for an unprotected metal surface; (4)
 - (b) explain the process of galvanic corrosion; (4)
 - (c) state TWO major factors influencing the severity of galvanic corrosion. (2)
7. With reference to the production of glass reinforced plastic (GRP) hulls:
- (a) outline the properties of glass fibre and resin that make them suitable for the construction of a hull; (3)
 - (b) describe the traditional method for the layup of a GRP hull; (5)
 - (c) list FOUR disadvantages of GRP hulls in service. (2)
8. (a) Explain, with the aid of a sketch, the design and operation of a thermocouple. (8)
- (b) State ONE limitation of the thermocouple, stating how this is overcome in practice. (2)
9. With reference to hydraulic governors fitted to alternators designed to run in parallel:
- (a) explain why these governors have adjustable integral action; (5)
 - (b) explain, with the aid of a load/frequency diagram, how two generators operating in parallel are able to achieve a stable load share with a 50/50 ratio. (5)
10. (a) Sketch a block diagram of a split range control system, used to control the jacket water temperature of a main engine. (6)
- (b) Describe the operation of this system. (4)