

# **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, 19 November 2021**

**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"><li>1. Candidates should note that 100 marks are allocated to this paper. To pass candidates must achieve 50 marks.</li><li>2. Non-programmable calculators may be used</li><li>3. All formulae used must be stated and the method of working and ALL intermediate steps must be made clear in the answer.</li></ol> |
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Materials to be supplied by examination centres:

Candidate's examination workbook
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## 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 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.
  - (a) List FOUR methods for non-destructive crack detection. (4)
  - (b) Describe TWO procedures from the methods listed in part (a). (6)
  
4. Describe, with the aid of sketches, FIVE defects that may be present on a weld produced using the covered electrode welding process. (10)
  
5. With reference to the cathodic protection of hull fittings:
  - (a) explain how sacrificial anodes achieve this; (2)
  - (b) state where sacrificial anodes would be fitted and why; (4)
  - (c) describe an impressed current system, stating the principle on which it works. (4)

6. With reference to osmosis in glass reinforced plastic (GRP) hulls:
- (a) explain how osmosis may be detected in service; (2)
  - (b) explain why simply drying out the hull is not a cure for the effects of osmosis; (2)
  - (c) describe the FULL process for the treatment of a hull suffering from the effects of osmosis. (6)
7. Describe, with the aid of a sketch, a floatation device that produces an output signal to remotely control the liquid level in a tank. (10)
8. (a) Explain the term *failsafe* in a control system, stating TWO examples where this term is applied. (4)
- (b) Explain the term *failset* in a control system, stating TWO examples where this term is applied. (4)
- (c) State what is meant by a 4:3 control valve. (2)

9. 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)

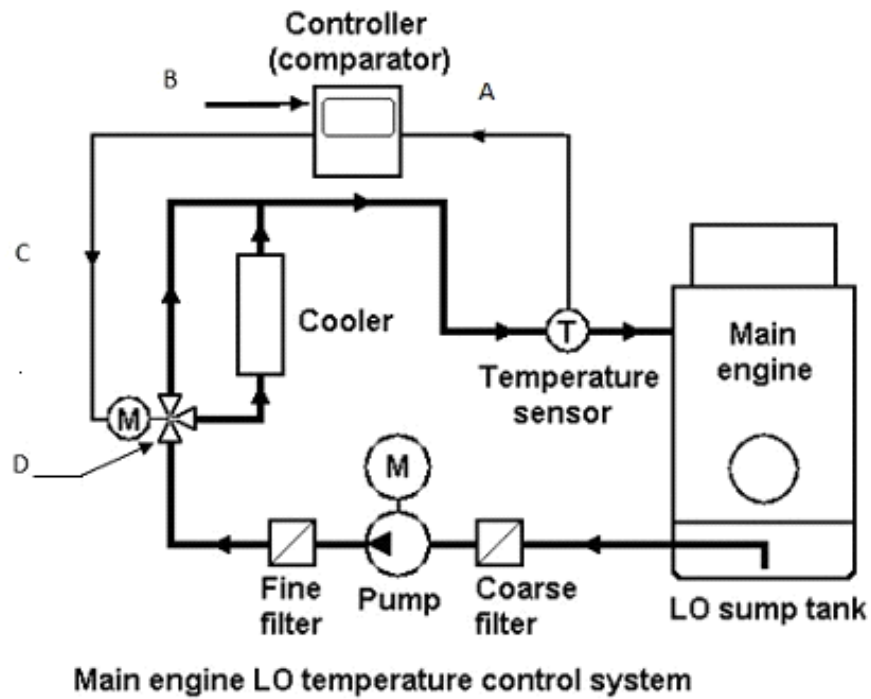


Fig Q9

10. With reference to the elevations of a lever bracket and pin provided below, produce a three dimensional freehand sketch of the component.

*Note: Marks will be awarded for dimensional accuracy and the quality of the sketch.*

(10)

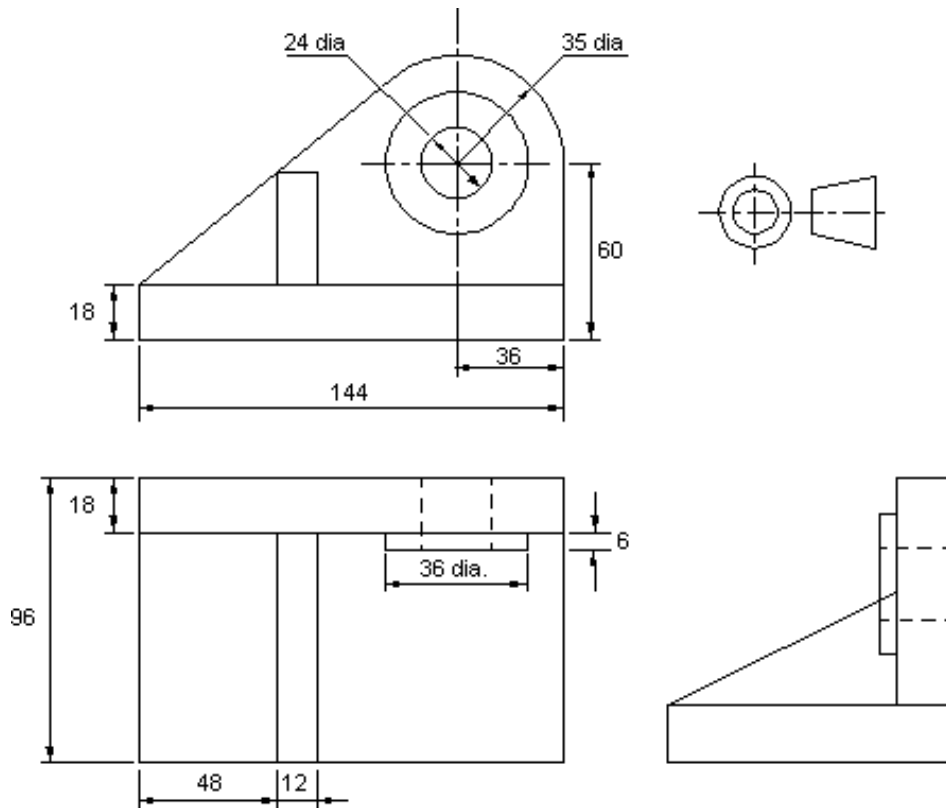


Fig Q10