

# 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, 18 March 2022

1400-1600 hrs

## Examination paper inserts:

Datasheet Q10

## 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 ship's side valves:

(a) state why grey cast iron is not a suitable material;

(b) state, with reasons, THREE suitable materials.

(6)

(4)

(6)

2. With reference to case hardening steel components:

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

(b) explain why it may be required;

(c) describe EACH of the following processes:

(i) a simple shipboard process;

(ii) solid pack carburising.

(8)

(3)

(2)

(3)

(2)

3. Explain EACH of the following terms:

(a) ductile cast iron;

(b) tensile stress;

(c) work hardening;

(d) shear stress;

(e) Young's modulus.

(8)

(2)

(2)

(2)

(2)

(2)

4. Explain EACH of the following terms:

(a) galvanic corrosion;

(b) cavitation damage;

(c) erosion damage;

(d) stress corrosion;

(e) atmospheric corrosion.

(8)

(2)

(2)

(2)

(2)

(2)



5. List THREE advantages and TWO disadvantages for EACH of the following welding processes:
- (a) gas tungsten arc welding (TIG); (5)
- (b) covered electrode welding. (5)
6. With reference to Impressed Current Cathodic Protection of a vessel's hull:
- (a) explain why it may be required; (2)
- (b) describe, with the aid of a sketch, the key points of installation; (5)
- (c) describe its operating principle. (3)
7. With reference to an impeller type flowmeter, describe how an output is produced and processed to provide EACH of the following:
- (a) an analogue output in litres per minute; (5)
- (b) a digital output in litres per minute. (5)
8. (a) Explain, with the aid of a sketch, how a Linear Variable Differential Transformer (LVDT) produces a variable output. (8)
- (b) State TWO applications of a LVDT onboard a vessel. (2)
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 *Derivative Action*. (2)
- (e) Describe the effect of excessive *Derivative Action*. (2)
10. With reference the Datasheet which shows a Hydraulic Circuit Diagram for a steering gear: (2)
- (a) describe how an electrical signal from the bridge to valve block X1 is processed by the hydraulic system to effect the change in helm; (5)
- (b) explain how this system functions if a large oil leak causes a float switch in the header tank to operate valve block X3. (5)



