# CERTIFICATES OF COMPETENCY FOR ENGINEERS (YACHT)

EXAMINATIONS ADMINISTERED BY THE
**SCOTTISH QUALIFICATIONS AUTHORITY**
ON BEHALF OF THE
**MARITIME AND COASTGUARD AGENCY**

**STCW 95 CHIEF ENGINEER (REG. III/3) – "YACHT 4"**

**056-02 AUXILIARY EQUIPMENT**

**FRIDAY, 22 FEBRUARY 2008**

**1400 - 1600 hrs**

Examination paper inserts:

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Notes for the guidance of candidates:

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| 1. Non-programmable calculators may be used.<br><br>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 colleges:

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| Candidate's examination workbook |

**AUX**

**Atte**

**Marks for each question are shown in brackets**

1. Describe, with the aid of a sketch, the operation of a double acting, piston type positive displacement pump. (10)

Similar to an air compressor. Both strokes of the piston are considered "Power" strokes. Thus, on the upwards movement of the piston, the piston is compressing or pumping. On the downwards stroke of the piston, it is also compressing or pumping.

It would usually be equipped with an accumulator tank to alleviate vibration and noise while the pump is running. The typical locations these pumps might be found would be for hand stripping tanks fuel storage or positive bilge pumps suction.

2. With reference to compressed air systems, explain the purpose of EACH of the following:

(a) fusible plug on compressor discharge; (4)

This plug will melt in case of any malfunction of the high pressure discharge valve. This is different than a regular pressure relief valve. It provides back-up to the pressure relief valve. The use of this is because carbon or other materials might block the regular operation of the valve. A fusible plug will operate based off melting point (3) (3)

(b) fusible plug on air receiver;

Same as above.

(c) bursting disc on water cooled air compressor.

To ensure that if there is any leakage from the high pressure side to the low pressure side or the air system to the water system, the disk will blow. This will keep the high pressure air from blowing into the water jacket and creating a high potential for explosion

3. Describe, with the aid of sketches, TWO methods for controlling the speed of a hydraulic motor. A varable speed moter or pump. (10)

q Constant Pressure System. Using pressure relief valves. The speed and directional control valves are designed

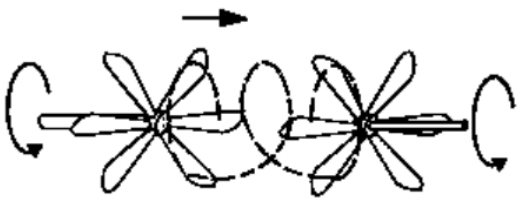
Draw a variable displacement pump. Swuash plate pump page 71 in notes.

4. With reference to hydraulic couplings for the main propulsion shaft:

(a) explain the <u>principle</u> of operation; (5)

(2)

(3)



Principle of the fluid clutch

The fluid coupling consists of two rotating parts fitted with vanes, one of which is the driving unit and the other the driven unit. The driving unit is connected to the engine and the drive to the output shaft or gearbox.

The impeller in the drive unit throws tl oil outwards and then into the impelle of the driven unit where the oil is then circulated back to the drive impeller.

Advantages:

- No shock can be transmitted through the coupling
- Overloads will not affect the prime mover, or stall the engine.
- No heavy torque when starting the engine
- Driven machinery is not subject to torsional vibrations

(b) state how the transmitted torque may be varied;

By controlling the oil flow through the rotating parts of the fluid coupling, the slip of the coupling can be changed, resulting in a variable output speed of the driven shaft.

(c) state THREE advantages.

Advantages:

- No shock can be transmitted through the coupling
- Overloads will not affect the prime mover, or stall the engine.
- No heavy torque when starting the engine
- Driven machinery is not subject to torsional vibrations

Disadvantages:

- ***Time to take up drive or release drive can be long. It is not an instantaneou make-break***.
- Slip is about 3%
- Costly to make

5. With reference to a vessel with a single electro/hydraulic controllable pitch propeller, explain EACH of the following:

(a) how manoeuvring may be maintained if the control system fails; (5)

In a variable pitch propeller, there is normally a permanent method of extending the control rod. This is done by a hand crank or socket arrangements. Using radio communication with the bridge, determine the best rpm and pitch to get home. (5)

(b) the action to be taken should the hydraulic system irreparably fail whilst on route and the blades assume zero pitch.

The first thing is to turn off the hydraulic system off. This should allow the automatic spring that is built into the propeller to bring it to it's default Full Ahead Position
Call a Tug

6. With reference to reduction gearing, explain EACH of the following:

(a) the purpose of the magnetic filter in the lubricating oil system; (3)

To grab any metal fillings that may be circulating in the oil lubrication system. This provides two functions. It can allow for inspection of the transmission. Particles indicate (4)
that abnormal wear is occurring.

(b) why the surface finish of the gear teeth is important; (3)

Surface finish ensures even loading. Un even loading will cause un even wear and in turn cause scoring and distructive pitting

(c) why EP lubricating oil is preferred.

Extreme Pressure Lubrication is preferred in gear systems to increase the lubricity to help with the wear on the gear trains.

7. With reference to two ram steering gears which incorporate spherical bearings:

(a) sketch an arrangement of rams and tiller, including fittings; (5)

adding rudder jumping clearance to the drawing

(5)

(b) explain why spherical bearings are required on the ram ends.

To allow for the movement of the rudder post on the vertical and horizontal plans.

8. (a) Explain the term *short circuit*. (2)

Short circuit is when an electrical load is by-passed in a circuit. It is not following the intended path. The circuit is 'shorted' because there is no resistance. Current is allowed to (3)
flow unrestrained from source and back.

(b) State the dangers of a short circuit. (2)

The main dangers of a short circuit is to the conductor wires provided in the circuit. Over current protections is designed to protect conductors from becoming a fuse for the (3)
system. This could cause a serious fire.

(c) State the device that is fitted to lighting circuits to protect against short circuits.

Some lighting circuits are alternatively protected by a **QUICK-blow** fuse which is placed in series before the resistive loads.

(d) Explain how the device stated in Q8(c) operates.

Fuses are built to melt when the resistive load becomes higher than the designed spec. If a large enough fuse is speced out (like a High Rupture Fuse) it will be designed with materials that will dissipate the heat to prevent the potential of a fire.

9. State, with reasons, FIVE advantages of Valve Regulated Lead Acid Batteries. (10)

1. High amperage efficiency.
2. Electrolyte is not contaminated by atmosphere
3. Minim maintenance required,
4. Some types can be used/stored in any position
5. Hydrogen emission are minimal

10. (a) Explain the meaning of the symbol 

(5)

Intrinsically Safe. This designation must be intrinsictlly safe area, and expolition proof fans must be fitted (5)

(b) Explain the term *flameproof enclosure.*

To contain anything inside the enclosure so that a spark or switch cannot ignite