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, 6 FEBRUARY 2009

1400 - 1600 hrs

Examination paper inserts:

Notes for the guidance of candidates:

1. Non-programmable calculators may be used. 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:

Candidate's examination workbook

AUXILIARY EQUIPMENT

Attempt ALL questions

Marks for each question are shown in brackets

1. Describe, with the aid of sketches, TWO methods for controlling the speed of a hydraulic motor. (10)

Using either a Hele-Shaw Variable Delivery Pump or a Squash Plate type pump.
OR
Using Constrictor Valves and Flow Reducing Valves

2. With reference to main air receivers:

(a) list FOUR safety features, stating the purpose of EACH; (8)

Fusible Plug: This is installed in the receiver to act as a safety against tank ruptures in the event of a fire. Usually made out of a material with a low melting point. It's a good practice to have the discharge of this run out of the engineering space, so as to not interfere with fire extinguishing equipment (2)

Safety Relief Valve: This serves as a protection against over charging the tank. It should be set to approx 10% above SWL, as determined by the manufacture

Information Plate: This will describe the Safe Working Load, date of manufacture, Hydraulic Test info

Pressure Gage: Installed on an air receiver to monitor the pressure inside the tank. This gage must have means to be isolated from the tank so that service of the valve can be performed.

(b) state the pressure at which the relief valve should lift.

The pressure at which the relief valve should lift should be determined by using the manufactures recommendations for the air receiver. Generally, about 10% above the designated 'safe working pressure' is a good rule.

3. State, with reasons, a type of pump suitable for EACH of the following services:

(a) main sea water circulation; (2)

Centrifugal Pump: These pumps provide high volume, low pressure flow to applications. As long as the pick-up is below the waterline, they perform perfectly in this application. (2)

(2)

(b) Oily Water Separator supply

Low volume Positive Displacement pump. The goal in OWS is to provide the unit with contaminated bilge water with the least amount of turbulence involved. A gear pump or reciprocating pump would be ideal in this application (2)

(2)

(c) emergency fire pump;

Multi-stage Centrifugal Pump: These pumps provide high volume, low pressure flow to applications. As long as the pick-up is below the waterline, they perform perfectly in this application.

If the pick-up is above the waterline, then a positive displacement pump might be better suited.

(c) main engine lubricating oil supply;
Positive Displacement Gear Pump. Oil supply to an engine should be provide with the least amount of aeration achievable. Suction can not be delayed, otherwise severe damage to the pump would be incurred. The PD pump is also the source of the oil pressure in the engine.

(d) bilge main.
Positive Displacement Reciprocating pump might be ideal hear. Normally the bilge pick-up is located substantially lower than most centrifugal pumps are rated to produce suction for.

A centrifugal pump might be used here if there is a means for priming the pump. Say for example the pump is located below the waterline and a venturi effect can be established by creating suction with the seawater and the opening the suction line to the bilge pick-up. Or if there is an educator or water priming ring connected to the pump to help with creating suction from the lower point of the bilge

4. With reference to positive displacement pumps:

(a) explain the need for a relief valve, stating where it would be fitted; (5)
A relief valve is installed in a positive displacement pumps discharge. This is placed in order to protect against over pressurizing the discharge lines from the pump. It's overflow can be plumbed back to the suction line or to the bilge. (5)

(b) explain when a pulsation damper may be fitted to the delivery line, describing how it works.
Accumulator tanks are one form of pulsation dampening that are often equipped on pressure sides of positive displacement pumps. This application is usually seen on higher pressure pumps, those of watermakers or hydraulic systems. The tanks are usually filled with Nitrogen, which is an inert gas and is not effected by temperature changes and doesn't quickly react with other gases

5. Describe, with the aid of sketches, how a controllable pitch propeller is secured to the tail-shaft. (10)

6. (a) Sketch a pneumatically operated friction clutch, labelling all parts. (7)

(c) State how the clutch may be operated in the event of air failure. (3)

7. (a) Describe, with the aid of a sketch, how the alignment of a propeller transmission shaft system may be checked. (8)

Angular misalignment can be measured by the following methods:

(2)

- Measuring the face gap with a feeler gauge at the top, bottom, left, and right of the coupling.
- Using an axial dial gauge fitted as shown above. The flange with the dial gauge is rotated and the readings taken at the top, bottom, left, and right

The parallel misalignment can be measured by the following methods:

- Place a straight edge (steel ruler), across the flanges and measuring the misalignment with a feeler gauge. This is done at the top and bottom for vertical alignment, and the left and right for horizontal alignment.
- Using a radial dial gauge fitted as shown above. The flange with the dial gauge is rotated and the readings taken at the top, bottom, left, and right. If the shafts are aligned, then the dial gauge readings at all four positions should be the same.

The alignment of the shafts should only be carried out when the following conditions are met:

- all permanent ballast is in place;
- all machinery (or equivalent weights) are in place;
- fuel, water, and temporary ballast filled to normal average operating levels; and
- the vessel is afloat in the water

(b) State the indications of a high bearing when the shaft is running.

An immediate indication of a high bearing on the propelling shaft is usually higher bearing temperature. If there is numerous bearings supporting the shaft, a substaintially higher temp reading while underway will indicate an issue. High bearing temp can also indicate lack of lubrication or failure of internal components. These things must be investigated before a decisive conclusion can be made.

If the shaft appears to have a noticeable hop in it, then it can be suspected that there is a high bearing or a bent shaft. Internal examinations of supporting bearings can indicate if a bearing is being cause excessive wear.

(10)

8. Explain THREE advantages of hydraulically fitted shaft coupling bolts compared to parallel, interference fit bolts.

- The bolts of a parallel interference bolt coupler can loosen with time. Once the hydraulic coupler is fit, the hydraulic pressure are released
- Hydraulic couplers do not have an orientation for their installation. The bolts of a parallel interference coupler are specific and can not be mix-matched.
- The force of fitting a hydraulic coupler ensures that no mis-alignment occurs. Hydraulic couplers are fit with approx 500bar of pressure. These couplers

practically make the joint a solid piece again. In a parallel interference coupler, the bolt holes couple elongate over time, causing mis-alignment to occur.

9. Outline the necessary precautions, as stated in COSWOP, for working near live electrical equipment, when it is essential for the safety of the ship or for testing purposes. (10)

- Exposure of the dangerous part must be the minimum necessary
- A responsible ships officer or other person must authorize the exposure
- Only a competent person may carry out the procedure
- Any person working close to the machinery must have enough clear space and adequate light while they are working
- Any person operating or close to the machinery must have adequate instruction in safe systems of work for that machinery, the dangers rising from it's operation and the precautions to be taken
- And
- A conspicuous warning must be placed on or close to the machinery
- All ship's electrical equipment and installations must be constructed, installed, operated and maintained in such a way that there is no electrical hazard to the ship or any person

10. With reference to electrical generation and distribution systems, explain EACH of the following:

(a) why an insulated neutral is preferred to an earthed neutral; (4)

In a earthed neutral system, a single earth fault will cause overcurrent protection to trip. This will isolate the load usually. If this is classed as an essential load or an emergency load, then the disabling of the individual system could cause serious safety consequences for the ship. (6)

In a insulated neutral system, two earth faults on two different systems must occur before there is enough voltage potential to operate the overcurrent protection. If there is only a single fault to earth the system will still function.

By checking the distribution boards "earth lamps", an engineer can see if there is a potential problem in the system. A single fault will show up on the lamps, even though all systems are still operational.

(b) how essential circuits are protected should main bus-bar overload occur.

Essential circuity, steering gear, navigational lights, watertight doors etc are protected by an overloaded buss-bar by being on a seperated feed portion of the buss. If the main buss overprotection is triped, the emergency service generator will come online and provide electrical feed to the essential service side of the buss.