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, 25 JANUARY 2008

1400 - 1600 hrs

Examination paper inserts:

Worksheet Q8 Worksheet Q10

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

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Marks for each question are shown in brackets

1. Describe THREE types of wastage that may occur on the internal surfaces of a ship's side valve that is made of modular cast iron. (10)

Erosion, Graphitization, Cavitation.
Graphitization – gradually removes the iron from the service in contact with sea water to leave soft black graphite

Erosion.. As water flows past the valve, the flow creates localized cavitation which over a period of time will wear the sealing parts of the valve.

Cavitation: due to the bends in the valve. Cavitation occurs due to a partial vacuum that is created and a flash evaporation occurs. This will cause pitting and wear on the parts of the valve

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

(a) main sea water circulation; (2)
Centrifugal Pump because it is Large Flow Low Pressure
(b) Oily Water Separator supply; (2)
low capacity positive displacement – smoother,, less turbulent, better separation. A Jabsco type pump likely. The pump is usually located after the oily water separator and pulls liquid through the system (2)

(2)

(c) emergency fire pump;
Multi Stage Centrifugal – because of high flow rate and the second stage incresses pressure to flow water to the extremities of the vessel. (2)

Usually outside the E/R. Self Priming arrangement must be incorporated due to likely positioning above the waterline. Probably up on the main deck. High Volume low pressure.

(d) main engine lubricating oil supply;
Gear Pump – good for a range of viscosities, creates pressure to be utilized throughout the engine lubricating spaces. Must provide pressure immediately, must have a pressure relief valve added.

(e) bilge main.
Positive Displacement Pump, Reciprocating type. This is ideal because it can handle small bits of material commonly found in bilges, it can pull a suction and it has the ability to run dry for a limited amount of time. A Centrifugal Pump may be used, if either equipped with a priming method (water jet or high pressure pneumatic educator) or if the pump is placed in the bottom of the bilge, connected to a motor via a long connecting shaft.

EMERGENCY BILGE INJECTION: Valve connected to a Main Bilge Line but is plumbed straight to the bilge manifold. There is no filters equipped on this valve. Used before you've lost power.

3. (10)

Sketch a system that is capable of supplying compressed air suitable for use in pneumatic control equipment.

The main idea here is that Control Air needs to have DRY air. Multi-stage dryers will be important for keeping moisture out of the control system. Pistons are made of self lubricating materials, keeping lubricating oils out of the product air. This allows for non-contaminated air for the system.

Fusible plugs, pressure relief valves can all be included as well. These things would be included in a starting air system, due to the higher pressures that are demanded by starting systems.

4. With reference to a hydraulic steering gear that incorporates variable displacement pumps, describe TWO methods that may be used to prevent the idle pump from motoring. (10)

Use of ratchet and pawls system. This engages on the coupler when the motor is not turning and the hydraulic pump attempts to turn the motor.

Non-return valve restricts the flow of hydraulic fluid from flowing in reverse.

5. List FIVE advantages of having a gearbox fitted in a main propulsion drive, explaining why EACH may be considered to be an advantage. (10)

- Reduction Gear: The gearbox can be designed in a way to mechanically reduce the output RPMs of the engine from a higher (inefficient engine speed) to a slow more efficient propeller speed
- Reversing Gear: Incorporated in the fitted gearbox can be a reversing idler gear. This allows the propeller thrust to be reversed without having to stop the engine and run the engine backwards
- Thrust Bearing can be combined with the gearbox, which allows for the thrust developed via the prop to be distributed through the boat via the engine mounting block. This can save space and weight for the ships load.
- Engine can be started in neutral. This allows lower starting loads on the engine and the drive gear.
- Two or more engines can be connected to one shaft. This can allow more versatile use of horsepower ratings.

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

Using laser and target system. It mounts to the shaft on either side of the coup link and calculates the mis-alignment of the shaft. (2)

You can also use a set of dial-gages to calculate the parallel and conical mis-alignment.

If it's a short shaft, say on a pump, a set of feeler gages can be used.

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

Heat and Noise. Reduce the power and keep the bearing cool if the possible.

7. With reference to remotely operated quick closing valves:

(a) state their purpose; (2)

Quick closing valves are normally fitted to fuel tanks in order to isolate the tank in the event of an emergency. They are normally controlled by a wire or a operating cylinder. (3)

(b) state where they would be fitted;

Quick closing valves are fitted directly to the main fuel tank supplying fuel oil to the engines. This is normally considered the 'day tank.' The trip activation control should be mounted in a space outside the machinery area, in order to close the valve in the event of an emergency. (5)

(c) describe how they are tested.

The quick closing valve is tested by activated the trip mechanism. The test should ensure that they valve is fully functional and reactivated. There is an internal spring (along with gravity) that will close the valve when the supporting bridge is removed (knocked down) by the activating control. One important measure is to make sure that the valve is reset properly after testing. The valve can appear to be open, but after an hour underway, the fuel supply to engines may create a vacuum. (this is from experience!) The testing of the valve should be done on a monthly preventative basis.

8. Worksheet Q8 shows the hydraulic system for the shock valves and automatic by-pass for a section of a rotary vane steering gear.

Using Worksheet Q8 to identify valves and ports, describe EACH of the following:

(a) the operation of the shock valves; (4)

The shock valves are set to the manufactures operating pressure for the rotary vane motor. In the event of overpressurization, by the force of a wave. They should drain via the dotted lines back to the header tank (6)

(b) the operation when the solenoid valve receives an actuation signal.

When the solenoid valve receives an actuation single, it opens it's ports allowing draining from the shock valves/pressure-bypass lines back to the header tank. This will happen when the vessel is moving straight forward and no movement signal is being given to the rudder gear. The pump keeps putting pressure into the system, but the excess pressure is diverted to the header tank instead of to the rotary motor.

9. (10)

Describe TWO methods that may be used on a main switchboard to detect an earth fault.

Earth lamps, earth meter

A meter uses a small amount of DC current inject red into the system and it measures the current though a transformer, this means the instilments can be rated at a much smaller voltage or current. This system is normally connected to an audible alarm.

The simplest way is to use a series of earth fault lamps. These are connected to each of the phases of the distribution board and ground, with a switch in the middle. If there is voltage potential, which is the normal state, then all three lamps will illuminate. If one of the phases has a short to ground (earth) then that lamp will not illuminate. The other two lamps should still glow. This system is good for large earth faults, on the magnitude over 60mAmps. But for smaller faults, a more sensitive type equipment is utilized.

Using a Ground Fault Monitoring System. This induces a small DC through the earth and can pick up something as small as 1mA. The instrument gives both visual and audible

indication in the event of an earth fault. The instrument can be set to trigger the alarm at any preset value of insulation resistance or leakage current. This type of arrangement has been developed to meet the regulations which demand that on circuits in or passing through hazardous zones, there must be continuous monitoring of the system insulation resistance. Visual and audible alarms are given if the insulation resistance falls below a preset critical value.

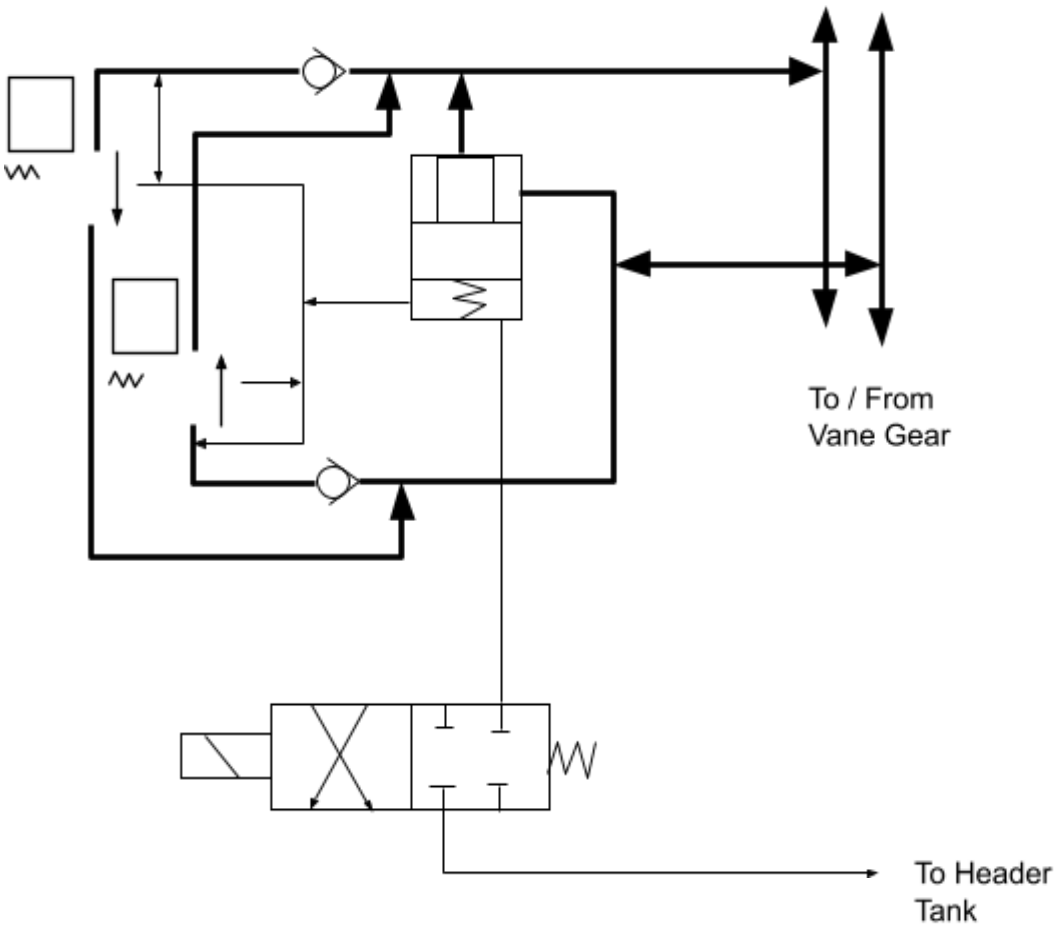
10. (a) On Worksheet Q10, sketch how an a.c. motor would be connected in EACH of the following:

(i) star; (3)

(ii) delta. (3)

(b) Explain why an a.c. motor may need a star-delta starter. (4)

An AC Motor utilizes a star-delta starter when the initial starting torque/current draw is too high for the distribution system. Star starting has the effect of reducing the starting voltage per phase to 57% of the line voltage. The low starting torque and starting current is gained, but can only be used with light starting loads. Page 428 in notes



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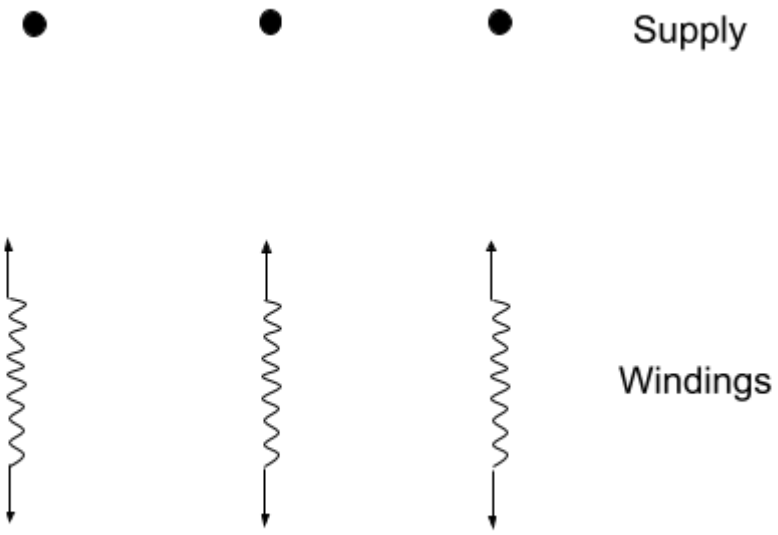
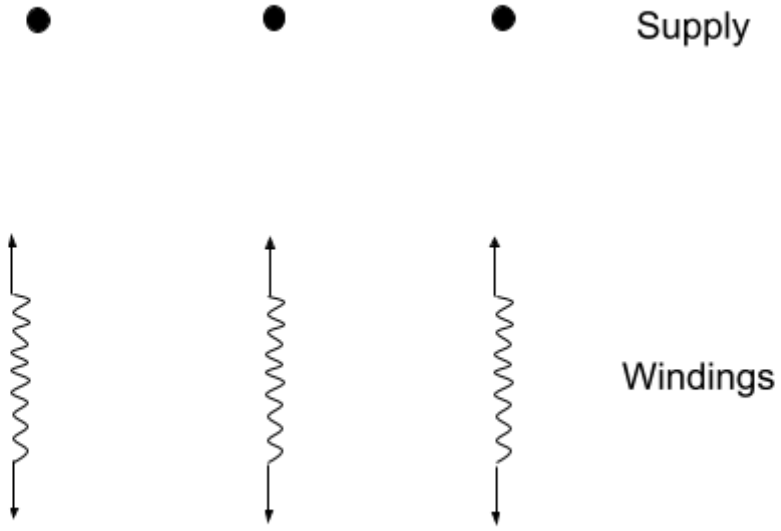
(This Worksheet must be returned with your answer book)

(i)



(ii)



Candidate's Name …… Examination Centre ……