

## Marine Engineering Exam Resource – Review of Hydraulics

1. What is Pascal's law?  
Pressure confined on a confined fluid will transmit the pressure in all directions and act with equal force on all areas at right angles.
2. How does the law pertain to hydraulics?  
In an enclosed hydraulic system pressure can be transmitted through hydraulic pipes and hoses.
3. What is Bernoulli's principal?  
When over the velocity (speed) of a liquid is increase at any point the pressure will decrease at that point.
4. What types of flow can be present in a hydraulic system?  
Laminar flow (strait). Turbulent (around bends)
5. What is the formula for force?  
Force = pressure x area,  $f = p \times a$ ,  $p = f / a$ ,  $a = f / p$ , system 2000 lb. Piston area 20 Lb./sq. In. Output force equals  $2000 \times 20 =$  a force of 40000 lbs.
6. What types of pumps are used in hydraulic systems?  
Positive displacement. (An amount of fluid has to move each stroke.)
7. How are most hydraulic pumps rated?  
Gallons per minute.
8. What types of gears can be used in a gear pump and why?  
Herringbone, - quiet and no thrust. Spur, - economical. Helical, - smooth flow.
9. What is a vane pump?  
Positive displacement pump which uses vanes to push the liquid around the housing to the outlet.
10. What is a balanced vane?  
Has two inlet ports and two outlet ports. Reduces the side loading on the rotor.
11. Which type of pump would you find a half moon shaped part?  
an internal gear pump. (Crescent pump)
12. What is meant by the term variable displacement pump?  
The output from the pump can be varied (flow rate) by changing the area of the pumping chamber.
13. What is meant by the term pressure compensated?  
As pressure is increased to maximize the output flow rate will automatically decrease. (Pressure regulator)
14. Which pumps produce the highest pressures in a hydraulic system?  
Axial - pistons are parallel with axis. Piston pumps up to 10,000 psi.

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15. What is the difference between an axial and a radial piston pump?  
Axial - is parallel to shaft (pistons working)  
Radial - piston working 90 degrees to shaft axis.
16. How can the displacement of piston pumps be changed?  
By lengthening or shortening piston stroke.
17. What is the rating system used on hydraulic filtering?  
Microns. 1 micron = 1 millionth of a meter or = .000039 of an inch. Filters are usually 5 microns.
18. What are the three main families of valves used in hydraulic systems?  
Pressure control, counter balance relief.  
Directional control, controls cylinder movement  
Flow control, controls speed of operation.
19. What type of valve do we use to control the pressure in a system?  
Pressure control valve. Pressure relief valve.
20. What is the purpose of a vent in the reservoir?  
No pressure in tank is built up just atmospheric pressure. Regardless of fluid level.
21. Where in the system does the valve in question 19 go?  
After the pump and before any other component in the system. (System safety valve) even before filter.
22. What is the pressure reducing valve and what is it used for?  
Reduces pressure like a relief valve but to a different direction to a secondary circuit at a lower setting than the relief valve.
23. What is an unloading valve and where is it used?  
A valve used to unload a low-pressure pump when the h.p. pump is the only one required in the system.
24. What is a sequence valve and where is it used?  
Controls the operation of two cylinders when one has to operate before the other. ie clamp and drill operation..
25. What is a counterbalance valve and where is it used? What is a break valve?  
Pressure control valve that maintains backpressure to prevent a load from falling.
26. How does a flow control valve work?  
(Needle valve) by changing the area through which the flow passes. Used to control the speed on a cylinder or motor.

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27. What is another name for a flow control valve?  
Volume control valve.
28. What is a check valve?  
A valve that allows flow only one way.
29. What type of valve normally controls cylinder movement?  
Directional control valve. Page 252
30. What is the different center ports available?  
Closed float  
Open tandem page 253- 255
31. A three position, four-way d.c.v. is connected to a cylinder with a pressure gauge on the b port. When the cylinder extends, pressure is applied to the A port. The gauge shows an increase in pressure but the cylinder does not move, what is wrong?  
B port is blocked. The directional control valve is blocked.
32. What is the most common type of cylinder used in hydraulics? What is another name for it?  
Double action cylinder or a linear activator. Page 294
33. What type of controls are used to activate directional control valves?  
Solenoid (electrical impulse)  
Pilot pressure  
Mechanical (lever) page 303
34. What type of component is used to store hydraulic energy?  
Accumulator pre-charged to half the working pressure. Page 298
35. What type of gas is used?  
Nitrogen. Page 301
36. How is pipe measured?  
Inside dimensions
37. How is tubing measured?  
Outside diameter
38. When hydraulic pressure is used to shift a valve, the valve is said to be?  
Pivot activated.
39. The outside diameter of tubing with a dash number of 8/16 would be?  
8/16 or ½ inch outside diameter.
40. The inside of a hydraulic hose with a dash number of 8/16 would be?  
8/16" or ½ " inch inside diameter.

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41. The pipe with the heaviest wall thickness is?  
Double extra heavy strength.
42. At a given pressure setting the force exerted by a hydraulic cylinder depends on?  
Affect over piston flow
43. Fluid under pressure passing through a restricted passage shows?  
Lower pressure or a pressure drop. Bernolles principal.
44. The difference between cracking pressure and full flow pressure is called?  
Cracking when a valve first starts to open. Full flow, valve full open. Pressure override, the difference between the two.
45. When velocity of a fluid is increased, pressure does what?  
Drops. Bernolles principal.
46. Where is a pressure line located?  
After the system relief valve. Before any other components on pressure side. Page 272
47. Where would you place a vacuum gauge on a hydraulic pump?  
On the suction side of pump.
48. If you install a new gear pump on a system and it did not deliver oil, what would be the mostly likely problem?  
Direction of rotation. Lack of oil. Plugged in tank. Air leak in suction.
49. What is the most important consideration when installing a pump above the surface of the oil to be pumped?  
The distance between the oil and pump level. As short as possible. Less bends and Corners as possible.
50. When pressure testing a cylinder under no load conditions, an increase in pressure indicates?  
Internal bending in cylinder piston.
51. If you found a hydraulic pump with a restricted suction line, what problems could occur if it is not repaired?  
Damage do to cavitation or (vapor or air bubbles)
52. How is the working pressure usually increased in a hydraulic system?  
Changing the settings on the relief valve.
53. If you replaced the sleeve or cam ring in a vane pump, what else should you replace?  
You should replace the vanes.

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54. What is the graphical symbol for the following:
- A. Relief valve
  - B. Sequence valve
  - C. Counterbalance valve
  - D. Unloading valve
  - E. Four way valve two position
  - F. Three way valve tandem centre
  - G. Double acting cylinder
  - H. Accumulator
  - I. Variable displacement, pressure compensated pump, pump variable motor variable
  - J. Filter reservoir vented pressurized pages 311 - 312