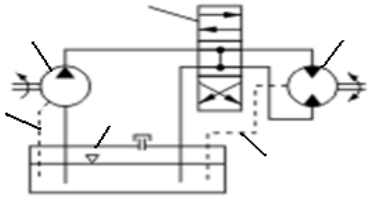
Self-Study Sheet-1 Part-2, on Chapter-1: Fluid Power Physics

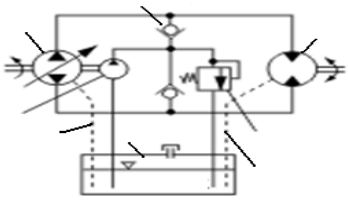
1-Show with a typical example how can hydraulics energy be used to increase the available applied force. Show what is the force magnification factor in your example?

2-Show with a typical example how can hydraulics energy be used to increase the available applied torque. Show what is the torque magnification factor in your example?

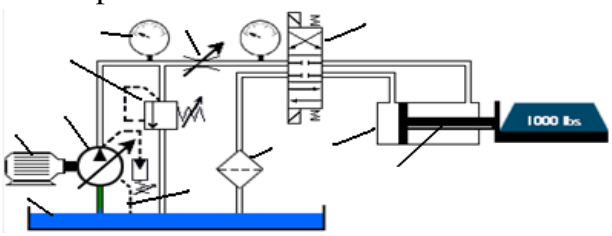
3-Next fig. is for……write the name of each part & state the advantages &disadvantages of this type. Use the following words:
Oil tank, directional control valve, fixed output PDP, hydraulic motor-drain, pump drain line, bi-directional hydraulic motor, Heat Exchanger.



4- Next fig. is for……write the name of each part & state the advantages &disadvantages of this type. Use the following words:
Oil tank, pump drain line, check valve, motor drain line, bi-directional hydraulic motor, charge pressure, bi-directional variable output pump, charge pump, Heat Exchanger.



5-In the next fig. of a hydraulic circuit, write the correct name of each part. You may use the following words:
Oil tank, pump drain line, electric motor, double acting cylinder, oil filter, pressure gauge, variable-output pump, flow control valve, piston rod, pressure relief valve, directional-control valve

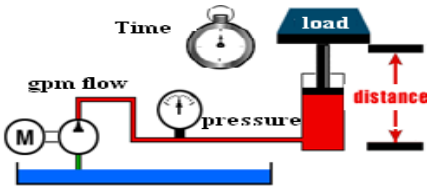


6- Select True (√) or False (x) for each statement:

#	True	False	statement
1			Hydraulics/fluid power is not used to transfer energy from a motor, or input power source, to an actuator or an output device in order to provide optimum work control of this actuator.
2			Work is defined as force x distance and is measured in units of foot-pounds or Newton x meter (1 N.m =1 joule)
3			Power is rate of doing work & measured in horsepower(1HP = 550 ft.lbs/sec = 745.7 Watt = 42.4 Btu/min)
4			In hydraulic circuits, 1 hp = flow (in gpm) x pressure (in psi) / (1714 x η_m)
5			Wasted Energy in hydraulic system that is not used for doing work will not be converted to heat in relief valve.
6			For hydraulic motor, Torque(in.lbs)=psixdisp.(in^3/rev)/6.28 = hp x 63025/rpm; and hp=Torque(ft.lbs)x rpm/5252
7			The speed of a cylinder piston is not dependent upon its size (piston area) and the flow rate into it
8			Hydraulic motors are actuators that are rated in specific torque values at a given pressure
9			Changing the flow rate to an actuator will have no effect on the actuator speed.
10			If cylinder is replaced with larger diameter one, the speed at which new cylinder extends & retracts will decrease.
11			For a fixed flow rate into a double acting cylinder, the extending stroke will be faster than the retracting stroke because the cylinder rod occupies space, decreasing the volume to be displaced.
12			Cylinder piston speed (ft/min)= gpm x 19.25 / Effective Area (in^2)
13			Gpm (theoretical) = Pump rpm x displacement(in^3/rev) / 231 ; where 1 galon = 231 in^3
14			Volume required (gpm) = [Volume Displaced x 60] / [Time (s) x 231]
15			Volume Required (hyd. Motor) = rpm x disp.(in^3) / 231
16			Pumps in hydraulic system produce flow while pressure is generated due to resistance in circuit components&lines
17			Load-induced pressure is defined as pressure generated from load or weight or force acting on actuator cylinder.
18			Pressure drop in circuit is the pressure required to push the fluid through lines & components up to the actuator.
19			Pressure drop in hydraulic circuit is not due to accumulation of viscous&flow resistance in all circuit components.
20			Pressure drop in hydraulic circuit will not be converted into heat losses in the hydraulic system
21			Pressure drop in hydraulic circuit is accumulative and must be added to the overall system pressure requirements.
22			Atmospheric pressure=14.7psia at sea level.Gauge readings do not include atmospheric pressure unless marked psia

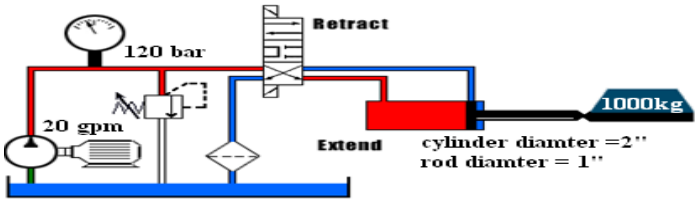
23			Hydraulic oil does not serve as a lubricant, sealant, Heat transfer element, and Energy Transfer element
24			Pressure drop in a fluid conductor is due to leakage
25			At given flow rate, increasing conductor diameter will increase the fluid's velocity
26			Viscosity is affected by the diameter of the fluid conductor
27			Hydraulic oil as lubricant allows the movable part to glide with less friction and wear on the parts.
28			With fixed fluid flow (gpm) through a pipe, the fluid velocity will increase if the diameter of the pipe is increased.
29			Viscosity is measure of liquid's resistance to flow.A thicker fluid has more resistance to flow and higher viscosity
30			As a hydraulic fluid's temperature increases, its viscosity or resistance to flow increases also.
31			In a viscometer, the time to fill the 60ml flask will increase if the oil temperature is increased

7- Define the "Hydraulic Horsepower. As shown in the next fig., find how many H.hp is needed to lift 10^4 kg a distance of 0.5 meter in 5 seconds? How much oil flow rate is needed at a pressure of 500 bar. Assume pump efficiency=90%.



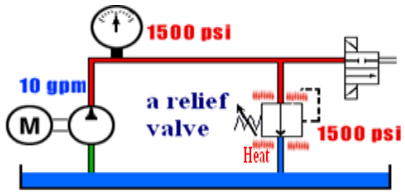
8- How many kWatts is needed to lift $3x10^4$ kg a distance of 4 meters in 7 seconds? How much oil flow rate is needed at a pressure of 520 bar. Assume pump efficiency=85%.

9- As shown in the next fig., find the required hp. Energy for both extending & retracting strokes. If the cylinder stroke is 50 cm, find the time for each stroke.



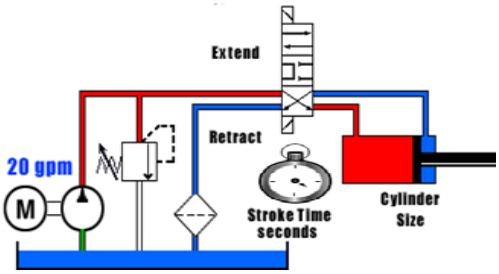
10- A 100 hp hydraulic motor runs at 300 rpm and 500 bar. How much torque is produced? What is the motor displacement? Motor efficiency is 95%. Assume any missing data.

11- As shown in the next fig., if pressure energy is totally converted to heat, find the heat produced if 10 gpm of oil is released through a relief valve which has a pressure setting of 1500 psi. Assume tank is at atm. Pressure.

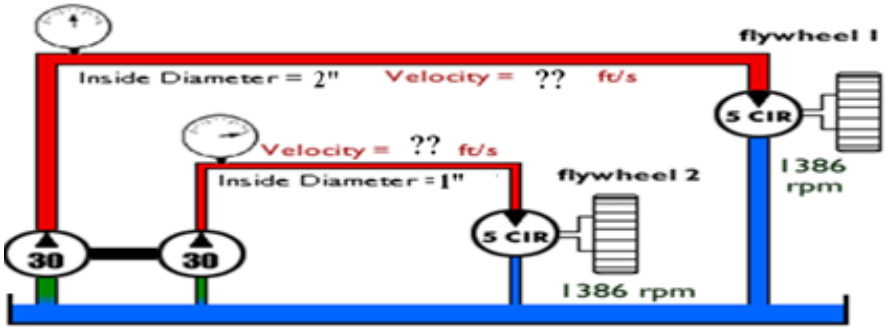


12- Define the term "load induced pressure". Give an example with some working numbers.

13- In the next fig., the cylinder is 4" diameter, the rod is 1" diameter and the stroke is 20 cm. Find the time for moving the load during both of the extending and of the retracting strokes.



14- In the example below, find the velocity of oil flow in both lines. Discus how can flywheel 1 and flywheel 2 have the same rpm?



15- Discuss the effect of pressure temperature on the viscosity of hydraulic oils. Give some typical examples. Describe two different methods for measuring the viscosity of common hydraulic oils.
