

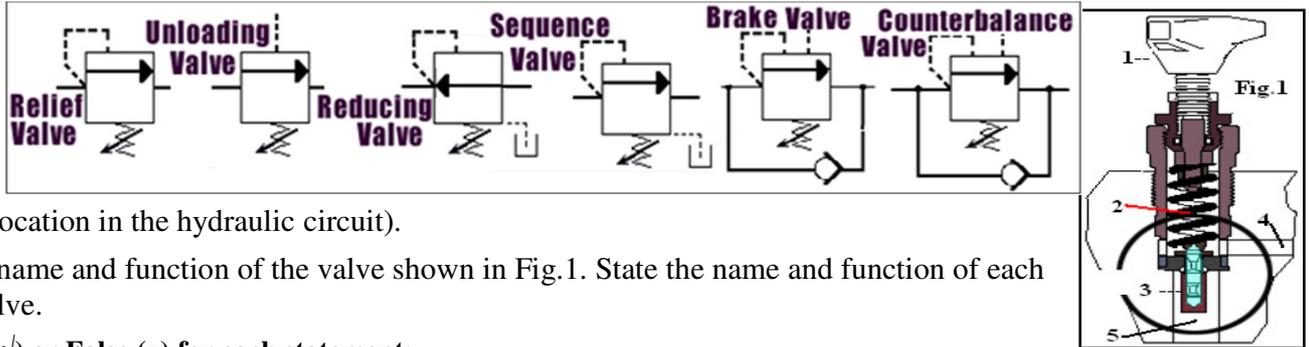
Self-Study **Sheet-4 Part-2, on Chapter-5: Pressure Control Valves**

1- Select True (✓) or False (x) for each statement:

#	True	False	statement
1			The two basic types of pressure control valves are direct acting valves and double acting valves.
2			In hydraulic circuits, the system pressure may be controlled accurately with an orifice or flow control device.
3			The symbols for different types of pressure control valves do not closely resemble one another.
4			The function and type of each pressure control valve is independent of its location in the hydraulic circuit
5			Primary function of pressure relief valve is to protect the system from excessive pressure and excessive overheat
6			Pressure relief valve should be used to direct excess pressure to the tank, as this may cause the system to overflow

2- In the next fig., define the function of each valve

(as the valve location in the hydraulic circuit).



3- What is the name and function of the valve shown in Fig.1. State the name and function of each part of this valve.

4- Select True (✓) or False (x) for each statement:

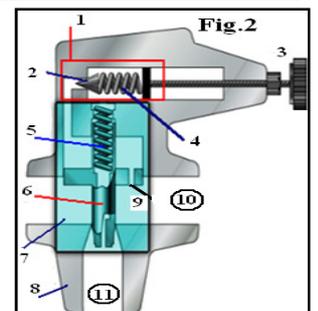
#	True	False	statement
1			Pressure relief valve is normally closed valve that controls both the maximum and minimum system pressure
2			In pressure relief valve, the primary port is connected to system pressure and secondary port connected to the tank.
3			The poppet in direct acting pressure relief valve is actuated by predetermined pressure level less than a spring force.
4			Pressure relief valve can be classified as direct acting valves or pilot operated valves
5			Direct acting relief valves only come in large sizes because they utilize a large spring directly against a poppet.
6			Direct acting relief valves usually come in small sizes because it is difficult to design strong spring enough spring to keep the poppet closed at high pressure and high flow.
7			The cracking pressure of direct acting relief valve must be less than the maximum allowable system pressure.
8			Pilot operated relief valves accommodate higher pressures with higher flows being confined to smaller frame size.
9			For the same pressure setting and flow rate, the direct acting valve shall be larger than a pilot operated relief valve
10			In Pilot operated relief valve, 1 st stage is small direct acting relief valve mounted across head on main valve body.
11			In Pilot operated relief valve, the 2 nd stage is main spool held in normally closed position by nonadjustable spring.
12			In Pilot operated relief valve, the 2 nd stage is large enough to handle the maximum flow rating of the valve.
13			In Pilot operated relief valve, 1 st stage controls and limits pilot pressure level in the main spring chamber.
14			The secondary port of a direct acting relief valve is connected directly back to the oil tank.
15			Pilot operated relief valve has larger flow capacity than direct operated relief valve of same frame size.
16			The 2 nd stage of a pilot operated pressure relief valve is a small direct acting pressure relief valve.
17			The small orifice in the main body of pilot operated pressure relief valve is called the pilot orifice.
18			The pilot orifice in the main body of pilot operated pressure relief valve does not create pressure difference between the pump line and the area across that orifice.
19			Pressure difference across the pilot orifice causes main poppet to move-off its seat to discharge extra pressure

5- Define meaning of “pressure override” in operation of pressure control valves.

6-Select from list below and write name of each part of the **pilot operated relief valve** on next **fig.2**. What is the function & what does the pilot orifice #9) do?

main valve body, non-adjustable spring, control knob, 2nd stage, pilot poppet, adjustable spring, main poppet spool, primary port, 1st stage pilot stage, secondary port, pilot orifice

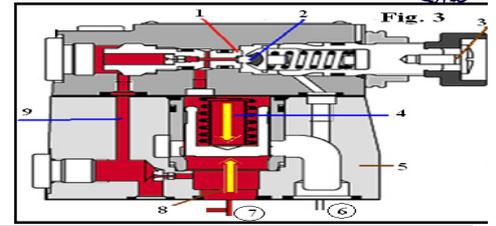
7- Explain the reason why (by the design) a pilot operated relief valve has a larger flow capacity than a direct acting valve of the same frame size.



8-Select from the list below &write the name of each part of the **Poppet Relief valve** on **fig.3**. What is function & what does the pilot control line #9) do?



Main valve body, 1st stage Pilot valve(with ball, secondary outlet port, primary inlet port, 1st stage Pilot poppet ball, System pressure line, 2nd stage Main spool cartridge, Pressure setting adjustment knob, control pilot line



9- State function & method of operation of valve in Fig.3(Poppet Relief Valve).

10- **Select True (✓) or False (x) for each statement:**

#	True	False	statement
1			Poppet relief valve is normally closed valve that controls both the maximum and minimum system pressure
2			In Poppet relief valve, the primary port is connected to system pressure and secondary port connected to the tank.
3			Main spool cartridge in poppet relief valve is directly actuated by predetermined pressure less than a spring force.
4			Poppet relief valve is classified as a direct acting pressure relief valve
5			Poppet relief valves only come in small sizes because they utilize large springs directly against a poppet.
6			The cracking pressure of Poppet relief valve must be less than the maximum allowable system pressure.
7			Poppet relief valves accommodate higher pressures with higher flows being confined to smaller frame size.
8			For the same pressure setting and flow rate, the direct acting valve shall be larger than a Poppet relief valve
9			In Poppet relief valve, 1 st stage is small direct acting relief valve mounted across head on main valve body.
10			In Poppet relief valve, the 2 nd stage is main spool held in normally closed position by nonadjustable spring.
11			In Poppet relief valve, the 2 nd stage is large enough to handle the maximum flow rating of the valve.
12			In Poppet relief valve, 1 st stage controls and limits pilot pressure level in the main spring chamber.
13			Poppet relief valve has larger flow capacity than direct operated relief valve of same frame size.
14			The 2 nd stage of a Poppet relief valve is a small direct acting pressure relief valve.
15			The control line in the main body of a Poppet relief valve is called the pilot control line
16			The pilot control line in the main body of Poppet relief valve does not create pressure difference between the pump line and the area across that control line.
17			Pressure difference across pilot control line causes main poppet to move-off its seat to discharge the extra pressure
18			Pilot operated relief valves characteristically do not have less pressure override than direct acting relief valves.
19			Pilot operated relief valves do not have slower response time than direct acting relief valves.
20			Pressure Override occurs when flow through the relief valve does not increase after the cracking pressure is reached
21			Due to the compression of the spring, the pressure does not still rise, or override the setting of the valve.
22			High flow valves do not require larger springs to facilitate larger valve assemblies
23			Larger springs in pressure relief valves do not contribute to higher pressure override in the valve.
24			Pressure override is the difference between the cracking pressure and pressure needed to completely open the valve.

11- Discuss the function of the Pressure sequence valve. Give an example using clamp & drill hydraulic circuit.

12- **Select True (✓) or False (x) for each statement:**

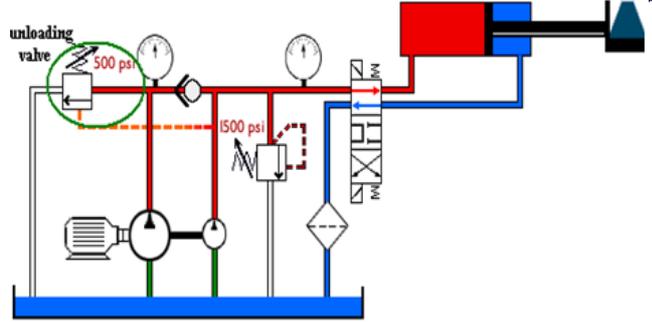
#	True	False	statement
1			Sequence pressure valve is not normally closed to insure that one operation occur before another based on pressure.
2			A sequence pressure valve is a flow control valve.
3			A sequence valve is normally open pressure control valve
4			The pressure downstream of a sequence pressure valve is limited to the sequence valve's setting.
5			A sequence valve may be direct operated pressure control valve or pilot operated pressure control valve

13- Sketch its symbol and discuss the function and method of operation of the Pressure reducing valve. Give an example using a proper hydraulic circuit. State if the valve is normally open or normally closed and why?

14- **Select True (✓) or False (x) for each statement:**

#	True	False	statement
1			Pressure reducing valve is not normally open pressure control valve.
2			Pressure reducing valve can not be used to limit the pressure in one or more legs of a hydraulic circuit
3			A pressure reducing valve is the only pressure control valve that is normally closed.
4			A pressure reducing valve is not a pilot operated pressure control valve
5			In pressure reducing valve, pressure at bottom of the spool is sensed from pilot line connected to secondary port
6			Pressure reducing valve is used to limit the maximum system pressure
7			Unlike other pressure control valves, pressure reducing valve senses its pilot from secondary port of the valve.

15- Consider the application of an unloading pressure control valve in the High-Low pump circuit shown in the next fig. This circuit incorporates a high flow pump of 28 gpm which unloads at 500 psi (i.e., the unloading valve opens at 500psi directing its flow to the tank) and a 10gpm pump which relieves at 1500 psi (i.e., relief valve opens at maximum system pressure of 1500psi directing its flow to the tank). What is the maximum theoretical input fluid hp required? If pump efficiency, $\eta_p=0.9$ what is actual hp_{act} required (note: $H_p = \text{pressure (psi)} \times \text{flowrate (gpm)} / 1714$).



16- Sketch its symbol and discuss the function and method of operation of the **Unloading Valve**. Give an example using a proper hydraulic circuit. Is this valve normally open or normally closed and why?

17- **Select True (✓) or False (x) for each statement:**

#	True	False	statement
1			A high-low pump system does not provide high volume flow at low pressure and low volume flow at high pressure.
2			High-low circuits are not used to extend and retract loads at low pressure and high flow rate, followed by high pressure, low volume flow to do the work when the load is contacted.
3			The High-low circuits do not allow components and input motors to be kept small which increases operating efficiency by sizing the system to load requirements.
4			Unloading valve is not remotely piloted and is not normally closed pressure control valve
5			Unloading valve directs flow to the tank when pressure at the pilot location reaches a predetermined valve setting.
6			High-low circuit is not designed to give rapid approach or return on the work cylinder.
7			In a high-low circuit, the total volume of both pumps is delivered to the work cylinder until the load is contacted.
8			After load is contacted in high-low circuit, the system pressure does not increase causing unloading valve to open.
9			As unloading valve is opened in high-low circuit, flow from large volume pump is directed to the tank at min. press.
10			As unloading valve is opened in high-low circuit, small volume pump keeps pumping for higher pressure work cycle
11			The amount of flow rate dictates when an unloading valve will open

18- Sketch its symbol and discuss the function and method of operation of the **Counter-Balance Valve**. Give an example using a proper hydraulic circuit. Is this valve normally open or normally closed and why?

19- **Select True (✓) or False (x) for each statement:**

#	True	False	statement
1			Counterbalance valve is not normally closed used with cylinders to counter a weight or potentially overrunning load.
2			When counterbalance valve is used in a hydraulic circuit, the load would not fall uncontrolled or overrun
3			when using a counterbalance valve in a hydraulic circuit, we do not put its pressure setting slightly above the value of the load-induced pressure caused by the weight on the cylinder
4			When extending the cylinder (in a counterbalance load valve circuit), pressure must slightly rise to drive load down.
5			Counterbalance valve can not be used to control cylinder with negative or running load to move at a controlled rate
6			Similar to function of counterbalance valves, Pilot check valve circuits can not also hold loaded cylinders in place.
7			Counterbalance valves have to be leak-free (e.g., leakage across a counterbalance spool is not more than drops/min.
8			If counterbalance valve is used to lock a cylinder in place, the valve must have zero or no leakage across the spool.
9			Counterbalance valves may not use external piloting for smoother, "non-hunting" performance.
10			In a loaded cylinder hydraulic circuit, the internal pilot in a counterbalance valve lowers the load with load-induced counter pressure while the external pilot drops all back pressure when performing the work

20- Similar to the counter balance valve job, Show how can a Pilot check valve circuits be used to hold loaded cylinders in place?

21- **Select True (✓) or False (x) for each statement:**

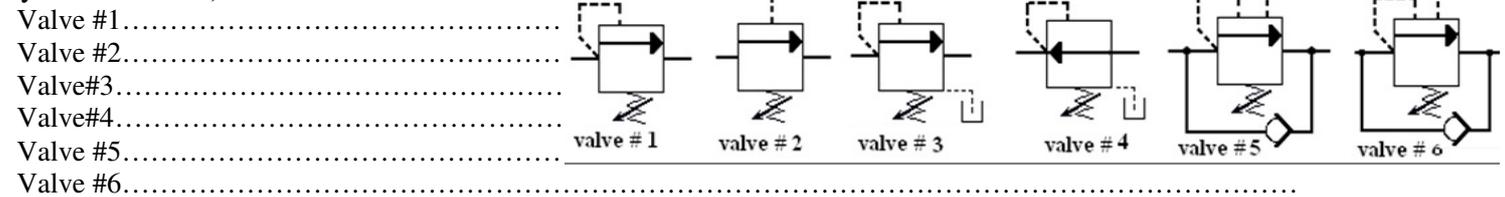
#	True	False	statement
1			Brake valve is not normally closed pressure control valve
2			Brake valve is a normally closed pressure control valve with only direct acting pilot pressure without remote pilot.
3			Brake valve is normally closed pressure control valve with both direct acting pilot pressure and also remote pilot

		pressure connected simultaneously for its operation.
4		Brake valve is not used with hydraulic motors for dynamic braking.
5		In hydraulic motor circuit, the brake valve uses remote pilot to maintain constant back pressure on hydraulic motor.
6		The brake valve has two pilot pressure connections for the purpose of allowing the installer more plumbing options.
7		In a hydraulic-motor circuit, if directional control valve is centered, the brake pressure control valve will not allow a controlled amount of back pressure to build in line between motor and brake valve to achieve dynamic braking.
8		Brake circuit utilizing a brake control valve is not necessary on a rotary actuator where speed control and stopping capacity are required.
9		Brake valve usually implies that it is used with a motor circuit.

22- Sketch its symbol and discuss the function and method of operation of the **Brake Valve**. Give an example using a proper hydraulic circuit. Is this valve normally open or closed and why?

23- Explain how can the Brake valve achieve “dynamic braking” when directional control valve is also used.

24- In the next fig., define the name and function of each pressure control valve (as the valve location in the hydraulic circuit).



25- Discuss the following statement (use the proper hydraulic circuit): “**The Pressure Relief valve limits the maximum system pressure**”.

26- Discuss the following statement (use the proper hydraulic circuit): “**The Pressure Reducing valve will limit the pressure to the motor, thus limiting the output torque of the motor**”.

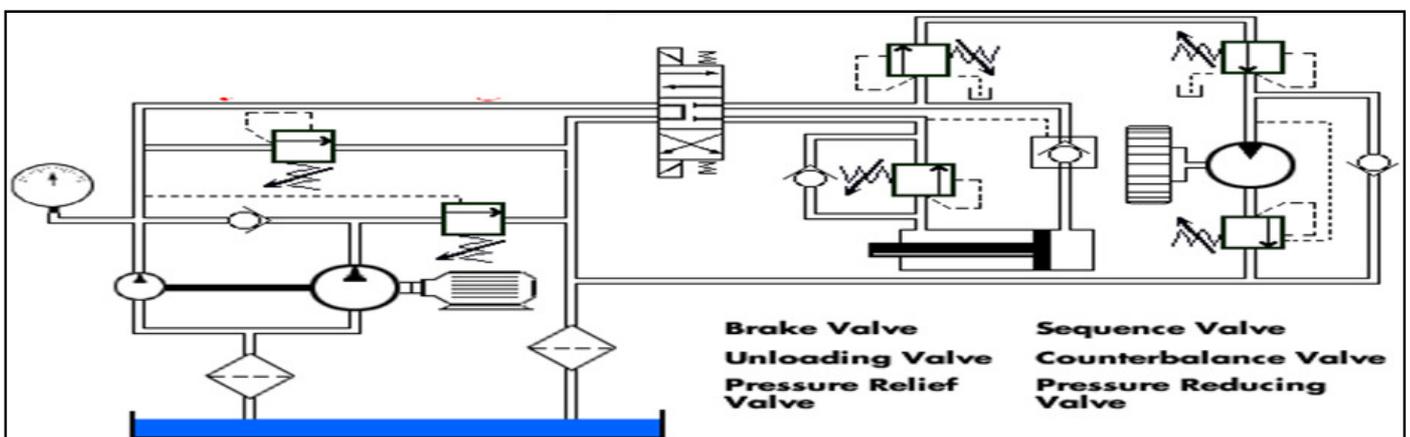
27- Discuss the following statement (use the proper hydraulic circuit): “**The Brake valve serves two purposes: it prevents a load from over speeding the motor, and when the directional control valve is centered, it brings the motor to stop at a controlled rate of speed**”.

28- Discuss following statement (use proper hydraulic circuit):” **when system pressure reaches the unloading valve setting, the valve opens diverting flow from larger pump back to the tank at minimum pressure**”.

29. Discuss the following statement (use the proper hydraulic circuit): “**Counter balance valves are used to aid a cylinder in lowering a load at a controlled rate**”.

30- Discuss the following statement (use the proper hydraulic circuit): “**If the Sequence valve is properly adjusted, the valve assures that the cylinder will fully extend before the motor starts**”.

31. On the figure below for a general hydraulic circuit, locate the correct name of each pressure control valve. State the function of each valve in this circuit.



----- End of Pressure Control -----